NYPL RESEARCH LIBRARIES
3 3433 06906141 8

Mechanics

~~Mechanics~~

3 VA

Mechanics

Mechanics

3 VA

VA

Digitized by Google

Digitized by Google

Digitized by Google

THE

MECHANICS' MAGAZINE,

AND

JOURNAL OF ENGINEERING, AGRICULTURAL MACHINERY,
MANUFACTURES, AND SHIPBUILDING.

V. LMGJ
NEW YORK
PUBLIC
LIBRARY

VOL. VII.
(NEW SERIES.)
JANUARY TO JUNE, 1862.

LONDON:
ROBERTSON, BROOMAN, & CO., "MECHANICS' MAGAZINE" AND PATENT OFFICES,
166 FLEET STREET, E.C.

LONDON:
JUDD AND GLASS, NEW BRIDGE STREET,
BLACKFRIARS, E.C.

1862

vol 7

INDEX.

A.

Aberdare colliery company, 8
Able, F.A., F.R.S., explosions, 279
Abridgements of the specifications relating to shipbuilding &c., 243
Accidents, railway, by Mr. J. Brunlees, C.E., 267
Achromatic bi-lens, Warner's improved, 33
Address of condolence to Her Majesty, 8
Admiralty, Deptford dockyard, 334
African mountains, 54
Air, mean temperature of, 352
Air pump, Roy's new double acting, 19
Albany and Boston railroad company, 413
Albert obelisk, the, by J. A. Davies, 216
Alexander's patent needles, 283
Allam, "aeronautic engineer," 302
Allan, Alex., on feed-pipe connection, 297
Allan's improved buffer, 48
,, lamps for railway carriages, 48
Alloys and metals, 60
Amalgams, experiments on, by J. P. Joule, LL.D., 52
America, Asia, and Europe, uniting by telegraph through Pacific ocean, 166
,, court at the International Exhibition, 361, 374
,, guns, 313
,, the oil springs of, 3
American Photographical Society, 207
Amos and Francis' slate dressing machine, 197
Ampere's experiments on electrical currents, Mr. J. Croll, 315
Analysing and comparing the forms of ships, Mr. R. Mansel, 61, 111
Anchors, Wilson's patent, 34
Annex, the western, at the Exhibition, 296, 308, 323, 341, 272
,, eastern, 324, 356
Antiquity of man, 117
Architects, Institute of British, 196, 199
,, ,, naval, 269, 201
Architecture, naval, 189
Armaments, the reduction of, by C. L. Pickering, 166
Armour fastening of mail clad vessels, W. H. Taylor, 259
,, iron, to resist heavy ordnance, J. E. Ashby, 397
,, naval, commission, 275
,, ,, question, 340
,, plates fastening, M. Roberts, 238
,, ,, manufacture of, Mr. J. Ford, 230
,, ,, ,, of, Mr. J. Brown, 122
,, ,, Royal Oak, 38
,, plating, new system of, Robt. Bowden, 183
Armstrong gun, 137, 164, 180, 231, 309, 332
,, ,, Lord Palmerston on, 173
,, Sir W., and Capt. Halstead, 133, 181
,, ,, and the *Times*, 259
Artesian well of the Royal Horticultural Society, 117
Artillery, new system of, 329
,, progress, 3
,, prospects, 95, 207
,, versus iron armour, 283
Arts, the Society of, 51, 116
Ashby, J. E., iron armour, 397
Ashcroft's patent railway chains and fastenings, 18
Ashmore, T., application of machinery to bread making, 255
Association, London Foremen Engineers, 23, 252, 377
,, ,, Prevention of Steam Boiler Explosions, 1
,, Manchester, Prevention of Steam Boiler Explosions, 14, 47, 65, 211, 160, 300, 364
,, National Rifle, 18
Atlantic survey, a new, 413
,, telegraph, 89, 154, 183, 214, 221, 235, 318, 332, 349, 355, 381
,, ,, Company, 197, 215, 366
Atmospheric disinfection, 8
,, electricity, observations on, 193
Attwood's surface scum-plate for steam-boilers, 180
Auriferous rocks of Victoria, 23
Austin, W., C.E., railway between England and the continent, 21
Australia court, the western, 366
,, engineering enterprise in, by J. Dyer, 68
,, Explorations and discoveries in, 292
,, Menangle viaduct, 406
,, telegraph in, 342
Australian sovereign, 357
Axleboxes, Blackburn's railway, 67
Aytoun's, Prof., watch regulator, 99

B.

Bamboo, the, its uses, 32
Barclay's improved crane, 210
Barometer, Howson's patent, 81
,, Major Walters' world's, 98
,, the long tube, Mr. R. Howson, 7
Barometers, their construction, Mr. R. Strachan, 20, 36
Barnet's Reflecting gas lamp, 267
Bars, Colquhoun and Thomson's furnace, 218
Baths, photographic ware, 23
Batteries, invulnerable floating, 221, 244
Battery, the Ericsson, by J. Norton, 129
Battle ships, disposal of, Capt. M. Harvey, R.N., 333
Baxendell, Mr., F.R.A.S., on the influence of the seasons, 26
Baylis's, patent chain harrows, 63
Beadon, Capt. G., R.N., steering ships, 253
Beam, the Hartley, 286, 301
Beardsley's earth elevator, 363
,, hay ,, 362
Bennett's method of tinning lead pipes, 196
Bentham, Sir S., 205, 223
Bessemer's process of steel manufacture, 20, 237
Blackburn's railway axleboxes, 67
Blake, E. W. (U.S.), new metals, 287
Blankley's inventions, 227
Blanzy, Pore, and Co., steel pen manufacturers, 302
Blasting by gunpowder, 133
Blowpipe, Dr. H. Sprengel's laboratory, 48
Boiler explosions, Association for Preventing, 14
,, ,, London Association for Preventing, 1
,, ,, Manchester ,, ,, 47, 65, 211, 160, 300, 364
,, ,, prevention of, 334
,, ,, ,, ,, by J. Bruce, 68
Boilers and engines, Giffard's, 407
,, incrustations of, 70
Bolton, Capt., telegraphic night signals. 227
Bradford's eccentric washing machine, 330
Braxton's new mode of steering ships, 209
Brazilian Government and life boat, 334
Bread-making machinery, Ashmore, T., 283
,, and German yeast, 81, 120
Breakwater, Webb's iron, 212
Bridge-building, 1
Bridge, Messina steel, Robert Mushet, 285, 301
,, new, at Blackfriars, 3
,, pneumatic pile, 38
Bridges, Sedley's iron and wood, of large span, 314
Bright, T. C., Red Sea telegraph, 285
British architects, 196, 199
,, Association, proceedings of the Balloon Company, 210
,, coinage in the eighteenth century, 318, 349
,, India, paper currency for, 270
,, industry, coal and, 395
,, Museum, trustees of, 254
Britt's folding propeller, 250
Bronze guns, 227
Brooke's telegraph insulators, 140
Broughton, J., adjusting needles of galvanometer, 377
Brown, Mr. A., submarine operations, 118
Brunel, Sir M. Isambard, 114, 174
Brunlus, Mr. J., on railway accidents, 267
Brunton and Mitchell's draw-cutting shears, 263
Bruce, James, anti-corrosive cement for iron ships, 308; aqueous theory—curious fact, 318; grand canal, Portsmouth to London, 348; sea embankments, 366
Bryant and May's safety match works, 199
Buffer, Allan's improved, 48
Building, International Exhibition, 173
Burnell, G. R., deep wells and borings, 80, 103

C.

Cable, Atlantic, 183, 237
,, local heat in the Red Sea, R. A. Glass, 268
Cables, list of the submarine telegraphs, 159
,, , speed of transmission in long telegraphs, 215
Cairns, Sir H., royal commission, 366
Calico dyeing since 1851, Dr. F. G. Calvert, F.R.S., 123, 144, 156
,, printing, 145
Calicoes, machinery for printing, 317
Calorific phenomena, notes on, J. C. Dyer, 263
Calvert, Dr. F. G., carbonaceous substances, 52
,, on the progress of calico dyeing since 1851, 123, 144, 156
Campin, Mr. F., straight girders, single and continuous, 270
,, theory of steam and other engines, 6
Canal from Portsmouth to London, J. Bruce, 348
,, the Suez, 334
Cannon-ball exploits, 23
,, 100-pounder, 329
Carbon in iron, 228
,, Jno. Stebbing, 269
Carbonaceous substances, the composition of, by Dr. F. G. Calvert, 52
Carter, J. P., [illegible]iner's haven of refuge, 184
Cast iron, by Mr. J. M. Oubridge, 252
,, and wrought iron girders, 88
Catastrophe, the Hartley, 43, 59, 75, 83
Centrifugal pumping machine, Gwynne and Co., 347
Chain harrows, Baylis's patent, 63
Change, small, 326
Channel railway, the, by W. H. James, C.E., 38
,, ,, the projected, L. Foster, 105
,, ,, ,, H. Cook, 146
Chaplin and Co., Hill Engine Works, Glasgow, 16
Chatham dockyard, vessels building at, 254
Charcoal as a ventilator, 135
,, its application to the ventilation of sewers, 143, 163
Charing-cross water works, 154
China, the new Cunard steamer, 100
Chemical Society, 52
Chemistry, application of, to the military art, J. Norton, 127
,, at the International Exhibition, 329
Cheverton, Benj., proposal for partially iron-clad vessels, 317, 412
,, ,, straight line v. wave line for vessels, 413
,, ,, ventilation of coal mines, 182
Civil engineers as shipbuilders, 75
,, ,, Institution of, 35, 54, 67, 194, 199, 267, 366, 280
,, and Mechanical Engineers' Society, 6, 87, 126, 197, 252, 270
Civilizer, science a, 16
Clark's improvements in furnaces, 5
Cloth, the manufacture of leather, 277
Coal and British industry, 395
,, ,, iron mining of South Yorkshire, by P. Jeffcock, 297
,, cutting machine, a new, 413
,, lecture on, 95
,, mines, gases and evil spirits in, Chas. Kidd, M.D., 167
,, ,, the ventilation of, 90
,, tar to prevent disease in potatoes, 54
,, varieties of, 135
Cochrane, A. A., on the Warrior's sailing qualities, 230
Cockey's gas apparatus, 312
Coffee roaster,
Coinage, British, in 18th century, 318, 349
Coining, counterfeit, 174
Coke, article on, 190; Muller's, 262
Cole, Capt., cupola ships, 299
Colliery, the Hartley accident, 111
Collins' improved apparatus for reefing and furling sails, 377
Colonies, the British, 168
Colours, aniline, dissolved in alcohol, 287
Colquhoun and Thomson's furnace bars, 218
Comparison of the year 1851 with 1861, Mr. B. Jerrold, 51
Communication, a rejected, J. Passmore Edwards, 284
Condensers, Rowan and Horton's surface, 268
Conisbee's two-colour printing machine, 332
Cook, H., on the projected channel railway, 146
Cooke, M. C., Indian products at the Exhibition of 1862,
Cooling, the laws of, 64
Cooper, G. B., new test for targets, 398
Copper and zinc, on the metallurgy of, by Dr. Percy, 18
Coradine's metal cutting machine, 34
Cork, production of, 70
Corporation of the city of London, 286
Correspondence, 7, 21, 38, 53, 68, 88, 105, 127, 145, 166, 182, 199, 214, 237, 253, 268, 285, 291, 317, 348, 332, 365, 380, 397, 412,
Correspondents, 7, 68, 105, 127, 145 166, 182, 253, 268, 285, 291, 348, 317, 332, 365, 380, 397, 413
Cotton gins, Platt and Richardson's improvements in, 51
Cotton, a substitute for, 366
,, powder, 70
,, , Whipple and Stafford's machine for combing, 315
Counterfeit coining, 174
Cowan, W., steam hammers, 106
Crinoline, the manufacture of, 254
Croll, Mr. J., remarks on Ampere's experiments of the electrical currents, 315
Crystal palace, proposed, in Paris, 63
Crystalization, 177
Cunard steamer, the China, 100
Cutting machine, double tenon, Powis and James', 376
Cupolas and fortifications, Macintosh's system, 365, 382

D.

Darton, S., on early steam navigation, 21
Davies, J. A., Albert obelisk, 216; application of direct rotation to locomotive engines, 68, 128; Great Exhibition building, 199, 238; kaleidoscope and colour top instruments, 7; mechanical cause of thunder, 68; new railway buffer, 53; self-moving machinery, 167; velocities of light in different media, 184
Davis, J. E., R.N., telegraphic communication with America, 198
Davy, Sir Humphrey, 8
Defences, our habour, 371, 389
,, the three lines of the Portsmouth, by J. Norton, 146
De Normandy's refrigerating apparatus, 84
Defries and Son's, leviathan workshops, 358
Delta of the Danube, description of, by Mr. C. A. Hartley, 194
Dialysis, and its application to the fine arts, 152

Distinguished men of science, 321
Doballe's apparatus for the escapement of water from steam engines, 330
Dwellings for the industrial classes, 391
Dyer, Joseph, engineering enterprise in Australia, 68
Dyer, J. C., notes on calorific phenomena, 265

E.

Earth-elevator, Beardsley's, N. Y., 362
,, the measurement of the, 302
Economic museums, 275
Edwards, J. P., rejected communication, 284
Eggs, how to preserve, and how to set a hen, 300
Electric production of hydrates of silex and alumina, 54
,, self-recording target, 193
Electrical storms, probable cause of, by Dr. Joule, 235
,, tests, 396
Electricity, observations on atmospheric, 103
Embankment, railway, across Dover Straits to France, 296
Engine-governor, Porter's marine, 248
,, hydropult, or portable fire and garden, 228
,, Lee's steam pumping, 360
,, marine, improvement, 31
,, Rotary, Hudson's, 18
,, Williams and Parkinson's carding, 161
,, work, a new spanner for, W. H. Eveleigh, 168
Engines, Ferabee's "bat"-feeding machine for carding, 346
Engineers, Civil Institution of, 35, 64, 67, 194, 199, 267, 366, 380, 396
,, Civil and Mechanical Institution of, 6, 87, 126, 195, 252, 270
,, Civil, as shipbuilders, 75
,, Foremen, London Association of, 23, 232, 286
,, Mechanical Institution of, 87, 297
Engineering project, gigantic suspension bridge in Italy, 176, 199
English, S., management of fire-engines, 295
England and France, uniting by rail, 253
,, the iron walls of, 136, 154, 175, 191, 206, 222, 246, 260, 276, 293, 310, 324, 342, 360, 373, 390
Exhibition building, by J. A. Davies, 199, 238
,, ,, the Great, by W. Fairbairn, LL.D., 234, 248
,, chemistry at the, 328
,, of 1862 compared with 1851, 334
,, International, 270, 286, 307
,, ,, American Court, 361, 374
,, ,, class 1., 6
,, ,, classes, 5, 7, 8, and 10, machinery department, 17
,, ,, eastern annex, 324, 356
,, ,, and inventors, 311
,, ,, notes on, 17, 47, 86, 100, 116, 141, 397
,, ,, opening of, 291
,, ,, electric telegraphs, &c., 387, 403
,, ,, what India is doing for the, 272
,, ,, western annex, 226, 308, 323, 341, 374
Exhibitions, influence of, on international progress, 375
,, notes on remarkable, 43
Evans' apparatus for generating gas, 361
Eveleigh, W. H., new spanner for engine work, 168
Explorations and Discoveries in Australia, 292
Explosions, Able, F. A., 279

F.

Fairbairn, W., on the Great Exhibition Building, 231, 248
,, ,, properties of iron, 397, 408
Farlar's improved sash fastenings, 212
Feed-pipe connection for locomotive engines, 297
Ferrabee's patent "bat"-feeding machine for carding engines, 347
,, vertical direct action high pressure steam engine, 410
Files manufactured by machinery, 229
Filtering apparatus for boilers, Sykes', 411
Finch's proposed improvements in the metropolis, 33
Fire-arms, Murcott and Hansom's breech-loading, 250
,, ,, Scott's breech-loading, 213
,, bridges, and boiler tubes, Harlow's, 49
,, brigade, Hodges' volunteer, 211, 366
,, ,, steam floating and land steam engines, 334
,, engine, Lee and Larned's steam, 251
,, ,, Merryweather's patent steam, 380
,, ,, Tongue and Green's portable, 312
,, engines, instructions for the management of, by S. English, 295
,, ,, trial of, at the International Exhibition, 407
,, ,, ,, of steam, 279
,, proof doors and shutters, Hogg's, 196
Fires, discovery of London, 327
,, London, 31, 339
Fitzmaurice gas retort, the, 180
Flax scutching machinery, improvements in, 33
Fletcher, L. E., steam boiler explosions, 160, 211
Float for discharging vessels, 298
Floating batteries, invulnerable, 221, 248
Flotation and parallelism, J. N. Selwyn, 253
Forde, H. C., telegraph cable, submarine, Malta to Alexandria, 380
Foster, I., projected channel railway, 105
Fountain, drinking, Burdett Coutts', 301
Fowler, J., new windlass for steam cultivation, 66, 88
France, the resources of, 83
French expedition to Mexico, 406
Fryer's patent steam propeller, 160
Fuel, 41, 60, 77, 80, 95, 135, 190
,, peat, 88
Furnace, new, for boilers, G. Walcott, 184
Furnaces, Clark's improvement in, 5
,, Holcroft's blast, 411

G.

Gas, a rival of, 366
,, apparatus, Cockey's, 312
,, engineering, International Exhibition, 403
,, Evans' apparatus for generating, 361
,, furnace, applied to glass houses, C. W. Siemens', 87
,, lamp, Barnett's reflecting, 267
,, regulator, Reid's, 50
,, retort, Fitzmaurice's, 180
,, vapour, application of, 79
Galton, Capt. D., railway accidents, 268
Galvanised pipes, the corrosion of, when conducting water, 263
Galvanometer, adjusting the needles of, by J. Broughton, 377
Garden roller, Nicholson's, in two parts, 178
Gauge, paraffine, or mineral oil safety, 196
German yeast and bread-making, 81, 120
Generator, a new steam, C. F. Hayes, 391
Geological discovery at Hastings, 216
Giffard's boilers and engines, 407
Gifford's injector, G. P. Grant, 334
Gigantic iron casting, 55
,, scheme, 54
Girders, single and continuous, straight, by F. Campin, 270
Gisbourne, F. N., electric target, 287
Glass, Mr., a dinner to, 247
,, R. A., social heat in the Red Sea cable, 268
Gold, Jewellers', 11
Gold mining and the gold discoveries made since 1851, 326, 346, 375, 392
Good iron, and how to get it, 213, 260
Gore, G., on vibrations and musical sounds, 229
Gorel's combined reaping and thrashing machine, 21
Gossip, Scientific, 7, 23, 38, 54, 69, 89, 107, 128, 146, 168, 189, 216, 238, 253, 270, 286, 301, 318, 334, 348, 366, 382, 398, 413, 430
Government survey of the China seas, 38
,, the Swedish, 7
Gourlay & Co.'s new screw steamer, 35
Graham's researches on dialysis, by W. Olding, 316
,, stone-dressing machine, 123
Great Eastern, new paddle-wheels for, 7
,, Mount Cenis Works, the, 23
,, underground treasury, the, 70
Greave's water regulator, 263
Greenwood's sawing machine, 266
Gun, a new, by G. Walcott, 215
,, Armstrong, the, 137, 161, 180, 231, 300
,, metal, a new, 147
Guns, bronze, 226
,, cast steel for, 287
,, competitive rifle, the, 309
,, more large American, 313
,, naval, 344
,, the size of our largest, 313
,, Capt. Fishbourne on, 421
Gunpowder, blasting by, 133
,, discussion on, by S. Parlby, 167
,, ,, ,, Prof. Joy, 142
Gurney, Mr. S., soiree at, 214

H.

Hale's grooved plug for taps, 228
Halstead, Capt., and Sir W. Armstrong, 133, 181
Hancock's patent pulveriser, 4
Harbour, Charlstown, 54
,, defences, our, 371, 389
Harlow's fire bridges and boiler tubes, 49
Hartley catastrophe, the, 43, 59, 75, 83, 89
,, ,, the causes of, by J. Short, 83
Hartley, C. A., description of the Delta of the Danube, 194
Harvey, Capt., disposal of battle ships, 333
,, ,, submarine explosive shells, 413
Hawkshaw, John, an address by, 35
Hay elevator, Beardsley, 362
Hayes' new steam generator, 291, 411
Hoyes, A. A., zinc-covered or galvanized pipes, 263
Heat, J. Walcott, 83
,, intense, 330
Hen, how to set a, and how to preserve eggs, 300
Hetherington, W., on revolving rudders, 128
Higgins and Whitworth's spinning and doubling machinery, 118
Hobson's improvements in steam hammers, 85
Hofmann, Dr. A. W., on mauve and magenta, 285
Hogg's fire-proof doors and shutters, 196
Holland, railways in, 4
Holcroft's blast furnaces, 411
Holyhead harbour, C. Paget, 166
Hopkins, T., on the present state of meteorology, 142
Horology, 11
Horological Institution, British, 253, 308
Horticultural Society, the artesian well, 117
Houses of Parliament, new, at Sidney, 31
Howson, R., on barometers, 7, 81
Hudson's rotary engine, 18
Hughes' high pressure tap for steam, 344
Humphrey's improvements in steam engines, 283
,, iron forts and batteries, 19
Hungerford, Brunel's footway across the Thames, 301
Hydropult, or portable garden engine, 228
Hydraulic press, Thompson and Stather's, 344

I.

Improved window arrangement, 228
Improvements, recent, in sewing machines, 180
Indelible writing, 13
Indian products at the Exhibition, M. C. Cole, F.S.S., 312
Indigo, a new source of, 117
Industrial classes, dwellings for, 391
Inglis, Capt., Royal Engineers, 331
Institution of Civil Engineers, 35, 51, 67, 194, 199, 267, 366, 380, 396
,, Mechanical Engineers, 87
,, of Naval Architects, 30
,, Royal, 427
International Exhibition, 307
,, ,, American Coort, 361, 374
,, ,, and inventors, 311
,, ,, building for the, 173
,, ,, class 1, 6
,, ,, eastern annex, 324, 356, 419
,, ,, electric and telegraphic apparatus, 387, 403
,, ,, gas engineering, 403
,, ,, India rubber manufacturers in, 420
,, ,, machinery department—classes 5, 7, 8, and 10, 17
,, ,, Mr. Milnes on, 393
,, ,, notes on, 17, 47, 86, 100, 116, 141, 399
,, ,, opening of, 291
,, ,, trial of fire engines, 407
,, ,, western annex, 308, 323, 341, 374, 419
,, ,, what India is doing for it, 27, 312
,, progress, influence of exhibitions on, 375
Inventors and the International Exhibition, 311
,, Institute, 382
,, ,, to unite the interest of inventors and patentees, 301
,, ,, J. E. Ashby, LL.D., 397
Iron armour *versus* artillery, 233
,, carbon in, 225
,, casting, gigantic, 53
,, clad, a new ship, 210
,, ,, vessel, partially, B. Cheverton, 317, 412
,, fleets of small countries, T. Quant, 351
,, forts and batteries, Humphry's, 19
,, girders, cast and wrought, 88
,, good, and how to get it, 243, 260
,, Lane's improvements in the manufacture of, 105
,, navy, our, 355
,, peach houses, 7
,, plated ships, J. A. Slater, 318
,, ,, ,, N. Barnaby, 88
,, ,, ,, of war, 287
,, ,, men of war, 307
,, plates, punching of, 398
,, protecting from rust, 140
,, properties of, and its resistance to projectiles, 397, 408
,, ship-builders and the government, 356
,, ships, anti-corrosive cement for, 398
,, ,, fouling of, 11
,, ,, weakness of, 151
,, tablets, enamelled, 209
,, walls of old England, 136, 154, 173, 190, 206, 224, 246, 260, 276, 293, 310, 324, 342, 360, 375, 390, 422
,, Warriors, controllable, G. Walcott, C.E., 167

J.

James's, W. H., Channel railway, 38
Jeffcock, P., coal and iron mining of South Yorkshire, 207
Jeffrey's, 32-pounder rifle, 214
Jerran, G. B., illuminating lighthouses, 126
Jerrold, B., on the year 1851 compared with 1861, 51
Jetty, new coaling at Devonport, 280
Jewellers' gold, 11
Joule, J. P., LL.D., experiments on amalgams, 52
,, ,, probable cause of electrical storms, 235
Jones's patent marking machine, 364
Joy, Prof., discussion on gunpowder, 142

K.

Kaleidoscope, improvements in, by J. A. Davies, 7
Kidd, Charles, M.D., gases and "evil spirits" in coal mines, 167
King frost, 54
Kingsley, Rev. C., on decay of trees, 89

L.

Laird, iron-plate committee, 366
Lamp and apparatus for optical telegraph, 391
,, for railway carriage, Allen's improved, 48
,, safety, 64
Lane's improved permanent way, 141
,, improvement in manufacturing iron and steel, 105
Lancaster's experiments in submarine warfare, 209
Latham, A. G., metallic lustre, 121
LAW REPORTS:
Young's patent for the manufacture of paraffine and paraffine oil, 234
Laws of cooling, 64
Lead pipes, 23
,, ,, Bennett's method of turning, 106
Leather cloth, the manufacture of, 277
Lectures on light, Prof. Tyndall, 16
,, ,, metallurgy of copper and zinc, Dr. Percy, 15, 29
,, to workmen, 50
Lee and Larned's steam fire engine, 251
Lee's steam pumping engine, 360
Leme's vent tap, 282
Lemoine's apparatus for forming pipe joints, 374
Level catastrophe, the Middle, J. Macintosh, 349
Library, the French Imperial, 349
Life-boat Institution, Royal National, 228
Lighting apparatus for light-houses, by A. Masselin, 297
Lighthouse at Great Ormehead, 382
,, the Wolf Rock, 295
Lighthouses, method of illuminating, G. B. Jerram, C.E., 126
,, Red Sea, 343
Light, lectures on, 16
,, velocities of, W. J. M. Rankine, 145

670/24

THE
ECHANICS' MAGAZINE.
LONDON, FRIDAY, JANUARY 3, 1862.

LONDON ASSOCIATION FOR PRE- ENTING STEAM BOILER EXPLO- ONS.

several years past the Manchester Associa- for the Prevention of Steam Boiler losions, has been in active operation; and have considered it our duty to publish its odical reports. There cannot, we think, be opinions on the excellency of the objects he institution, and the admirable manner in h it has been conducted. A similar asso- ion is now established in London, and if we judge from the character of its president, William Fairbairn, and of the nineteen tlemen who already constitute its council, may reasonably expect that it will be as conducted and as useful in its results as Manchester prototype. The names of the nbers of the council of the new association as follow:—

n. Adams, Esq., C.E., North London Railway.
F. Bateman, Esq., F.R.S., M. Inst. C.E.
nol Brough, Esq., Govt. Inspector of Mines, W. Dist., Bristol.
s. Brunlees, Esq., M. Inst. C.E.
ed. Braithwaite, Esq., M. Inst. C.E.
E. McConnelll, Esq. M. Inst. C.E., Lon. and N. W. Ry.
C. Craven, Esq., C.E., Lon. Brighton and S. C. Railway.
obt. Davison, Esq., M. Inst. C.E.
obt. Galloway, Esq., C.E., Steam Inspec. Board of Trade.
aniel Gooch, Esq., C.E., Great Western Ry.
ean John Hoare, Esq., F.R.G.S.
. Lamb, Esq., C.E., P. and O. Steam Nav. Co. (Southampton).
obt. Richie, Esq., C.E., R. Mail Steam P. Co. (Southampton).
obt. Sinclair, Esq., M. Inst. C.E. Eastern Counties Ry.
harles Vignoles, Esq., F.R.S., M. Inst. C.E.
. Wightman, Esq., A. Inst. C.E. L. and Blackwall Railway.
Edward Woods, Esq., M. Inst. C.E.
Professor Williamson, University College, Ph. D., F.R.S., Vice President Chemical Soc.
Thos. Wickstoed, Esq., M. Inst. C.E., Hon. Mem. Royal Cornwall Polytechnic Soc., &c.

We think we may with propriety say that it would be scarcely possible to bring together a similar number of men better calculated to perform the task contemplated. The association therefore, commences its existence with everything in its favour. It supplies an obvious want; its predecessor and example has been successful, and its direction is unimpeachable.

Perhaps, we cannot do better than state the precise objects of the association. It is established in the first place, to prevent steam-boiler explosions by efficient *voluntary* inspection, and thus render unnecessary that Government interference which juries upon inquests continue to demand as necessary for public protection where regular inspection is neglected. 2nd. To assist all who employ steam power to do so in the most economical and efficient manner, to accomplish which boilers and engines are examined not only with regard to their safety, but also to their economic and efficient working; diagrams are taken from the cylinders, their power calculated, the consumption of coals investigated and reported on by the chief engineer who is always ready to impart to the members of the association information of any mechanical improvements that may arise from time to time, and to place within the reach of each member the experience of, and information accumulated from, the whole number of boilers inspected.

The Manchester Association has been in existence about six years, and during that period it has made nearly 50,000 boiler inspections, each case has been reported on, and 457 dangerous defects, from which accidents might have arisen, have been pointed out. When it is remembered that only three explosions have occurred to boilers inspected by the association since its commencement, we may form some idea of the loss of life and property thus prevented. One of the explosions arose from over pressure persisted in after advice had been given to the contrary by the engineer of the association, another arose from neglect during the absence, through illness, of the regular qualified engineer attendant, and the other from shortness of water, which the attendant failed to observe, although his boiler was fitted with a glass water gauge, the deficiency of which was caused by a break-down of the feed valve. On the other hand it was ascertained from a limited inquiry only, that during the same six years, no less than 155 fatal explosions occurred to boilers not under the inspection of the Association. These explosions were attended with the loss of 341 lives, in addition to serious injury to 376 persons, and considerable damage to property.

Members of the Association recently started in the Metropolis are entitled to the following services and benefits:—Four careful examinations of their boilers and engines every year, with a written report thereon in each case, one of these examinations being made by the chief engineer, and the other by a competent inspector. At these visits, all the boiler mountings are carefully inspected; the safety-valves tested; the correctness of the pressure-gauges checked by an indicator, with which the inspector is always provided; the blow-off and gauge-cocks tried; the feed apparatus examined; and the attention called to any defect either in the condition, arrangement, or number of the fittings. At the same time, it is ascertained whether the construction of the boilers is suitable for the pressure at which they are worked, and the condition or state of repair of the plates is examined, as far as they are accessible to examination. And, in order that these examinations may be quite complete, it is only necessary for the members themselves to afford the opportunity of their being so, by stopping their boilers and sweeping the flues. The inspector will then go inside the shell, as well as up the internal and external flues, examining the surface of the plates, internally and externally, carefully sounding them to detect either hidden blisters, thinning by corrosion, incipient cracks, or flaws of any description, also noticing the amount of incrustation, with its effect upon the stays, as well as gauging the internal flues to detect the first signs of flattening, and pointing out all defects he may find. Such an examination is technically termed a *thorough* examination, and the Association affords its members one such of every boiler yearly, the other three examinations being external, when the steam is up and all in full work. Thus the boilers are examined both while at work and at rest, without which complete inspection cannot be secured.

Should members wish further advice with regard to their boilers and engines, they have an opportunity of communicating personally every Tuesday with the chief engineer, at the offices, unless he be called elsewhere on important business; and they have also access to the results recorded in the offices of the Association.

The members of the Association consist of subscribers, who are divided into two classes. 1. Persons who place steam boilers under the inspection of the Association. 2. Persons who do not use steam boilers or place them under such inspection. The expenses of the Association are met by an entrance fee of two guineas and an annual subscription from all members of one guinea. The annual subscription from members having boilers inspected by the Association is according to the following scale:—

1 Boiler	30s. per year.
2 and 3 Boilers	25s. each per year.
4 and 5 Boilers	21s. each per year.
6 and 7 Boilers	19s. each per year.
8 and 9 Boilers	18s. each per year.
10 and above	17s. each per year.

The entrance fee fund is to be reserved by the council for the purpose of promoting such experiments and investigation as may assist to astertain the causes of boiler explosions, or may otherwise promote the objects of the Association. The district to which its operations extend covers that part of England south of the line drawn across the country from east to west, through and including the towns of Yarmouth, Rugby, Warwick, and Aberystwyth. We think the Association can hardly fail to secure extensive patronage and support, neither do we doubt that its operations will be useful.

BRIDGES AND BRIDGE BUILDING.

IV.

(*Continued from page 337, vol. 75.*)

We owe some sort of apology to our readers for having made so long a *hiatus* in our series of papers on the above subject, and for having thus extended it to a new volume and a new year. It will, perhaps, be remembered that our story was broken off at a point where the late Mr. Rennie had just completed the erection of Southwark-bridge, namely, in March, 1819. It will be necessary, however, to the proper completion of our sketch of the history of the Thames bridges, to retrace our steps somewhat, and to take a further glance at old London-bridge. It had long been predicted that the occurrence of the first severe frost would prove fatal to that structure. In 1814, the river became blocked with ice to such an extent that a great fair was held upon it, and which lasted for some days. During this period, a very careful examination of the old bridge was made, and public attention having been directed to its unsafe condition, reports were made by Messrs. Dance, Chapman, Alexander, and Montague, to the Committee of the Corporation of London, recommending the substitution of four large arches for eight of those of the old bridge. A report was, however, made soon after by a Select Committee of the House of Commons with regard to this proposition, and adverse to it.

The House of Commons recommended that instead of altering and patching up the old bridge, which would be attended with a great deal of expense and uncertainty, a new bridge should be erected, and this after a design already made by Mr. G. Rennie, at the instance of his father. Mr. Rennie's idea was to construct, first a temporary bridge of wood, and then to build a new stone one on the site of the old. This plan would have met many objections of the citizens of London, who were averse, in the first place, to a new bridge at all, and in the next, to the site being altered, if a new one were to be erected As some time would necessarily have been consumed in the construction of the temporary bridge, it was at length decided, in order to inconvenience the public as little as possible, that the site should be removed, and that the old bridge should be made to sustain the traffic until the new one was completed. It was considered advisable, too, for the purposes of navigation, to make the headway of the new structure equal in height to that of Southwark-bridge. This involved the necessity of raising the approaches, and, consequently, entailed much additional expenditure.

In 1821, and before anything was positively decided, Mr. Rennie, senior, died, and fresh measurements were made, both of the river and the old bridge. During the whole of the next session of Parliament (in 1822) the subject was again agitated in Committee of the House of Commons, and there appearing to be still considerable diversity of opinion as to the best means of proceeding, the Corporation advertised for plans, and premiums were awarded for three of those sent in. After much further discussion in Parliament, in 1823, Mr. Rennie's design was definitively accepted, and the execution of it entrusted to his sons, George and John.

Mr. George Rennie happening to hold a Government appointment, that of Superintendent of Machinery at the Mint, was considered to be disqualified for holding the ostensible post of engineer of the works, and his younger brother, John, was nominated acting engineer. Contracts were soon after advertised, and the tender of Messrs. Joliffe and Banks being the lowest, they were selected to carry out the works. The Act of Parliament required the parties to take down and sell the old bridge; either leaving it standing until the completion of the new one, or erecting a temporary structure before removing it; to build a new edifice of granite, either on the old site, or within 180 feet westward of it, with convenient approaches, according to the design of the late John Rennie, Esq., any alteration with the engineer and contractor being previously submitted to the consideration of the Lords of the Treasury.

On the 4th of March, 1824, Messrs. Joliffe and Banks commenced their operations, as contractors, by examining the bed of that part of the river where it was proposed to erect the bridge, by means of the diving bell. This valuable apparatus, which had been introduced by Mr. Smeaton, at Ramsgate Harbour, and as our readers are aware, was subsequently improved, and largely employed by the late Mr. Rennie, was now found of great value. By its aid, the contractors made themselves completely aware of the nature of the river's bed, and of the obstacles they were likely to have to contend against in their pile-driving, and other foundational operations. The first pile for the coffer-dam of the south pier was driven on the 15th of March following, and it was soon found necessary to clear away the stone and chalk rubble, which, originally deposited round the foundations of the old bridge, had been washed upward to the site of the new one, and formed a serious impediment to pile-driving. A dredging machine effected this speedily, and the first dam was proceeded with with so much vigour, that by the month of October, of the same year, it was nearly completed. The second pier coffer-dam was commenced on the 3rd of May, and the Southwark abutment-dam about the end of September. A steam-engine was erected for pumping out the water from the south coffer-dam, and this made the sum total of proceedings during the year 1824.

On the 1st of April in the following year, the first coffer-dam being closed, the braces and supports having been fixed in the interim down to low-water mark, and clay filled in between the exterior and interior rows of piles, the engine was set to work, and the water in the dam pumped out. Notwithstanding the fact of the dam extending to the depth of twenty-nine feet below low water mark, it proved to be remarkably tight. About the end of the same month, the excavation was commenced, and this was continued until the 7th of May, when having entered into a fine stiff clay, the first bearing piles for the foundation were driven. By the 15th of June following, preparations for the laying of the first stone were completed, and on that day the ceremony actually took place.

The Duke of York officiated, and was assisted by the Right Hon. John Garrett, Lord Mayor, the committee for carrying the bridge into execution, and the Corporation of the City of London. The dam was beautifully decorated within and without with flags of different nations, and was divided into four parts, consisting of a floor and three galleries, the whole capable of accommodating 2,000 spectators. The foundation stone was of the finest and hardest Aberdeen granite, measuring in length 5 feet ¾ of an inch; in breadth, 3 feet 6¾ inches, and in depth, 2 feet 10 inches. Its contents were, therefore, 50 feet 7 inches, and its weight was four tons. Below the stone were placed, as usual, a set of the current coins of the realm, and a brass plate, appropriately inscribed. These, no doubt, will prove, some day, subjects for the consideration of that Society of Archæological New Zealanders who will establish themselves in London—once Macaulay's prophecy shall be fulfilled. At five o'clock in the evening of the day named, the stone was lowered into its place, amid noisy demonstrations of approval, and on the following morning the contractors proceeded with their work.

An alteration in the original plans was now determined upon, and this consisted in widening the whole structure to the extent of six feet eastward. Fortunate would it have been for us now if that alteration had extended to sixteen instead of six feet only! This change, however, involved a considerable amount of labour at the time, and was attended with some difficulty. The foundations had, indeed, to be lengthened, and the joining of the additional masonry required to be effected with much care. It was accomplished, nevertheless, without accident.

The works connected with the second pier from the south side were proceeded with simultaneously with those of the first, and a like addition was made to the length of the foundations for it. The experience gained in the carrying forward of these operations made the construction and arrangement of the dams and foundations for the other piers comparatively simple, and during the years 1826-27, and '28, much progress was made with the superstructure.

In the course of the year 1829, the centres of the middle, fourth and fifth, arches were shifted back; and when relieved of their load, the middle arch was found to have sunk 2½ inches, the fourth 2¼ inches, and the fifth, or last arch, 1¾ inches. The whole of the masonry was brought up between the spandrils to the regular curve of the cornice, and a considerable portion of the cornice laid on. The landings, stairs, and various minor parts of the bridge, were likewise advanced, and the centres entirely removed; capacious sewers were carried under both approaches of the bridge, and the roadway over it was partly formed. The protracted discussions about the approaches to the structure retarded greatly the Thames Street, and Tooley Street land arches. In fact, the end of 1830 had arrived before these arches could be even commenced. By the first of August, 1831, the New London Bridge was completed, and the ceremony of opening it by their Majesties, King William IV. and Queen Adelaide, we shall allow Mr. George Rennie to describe in his own language:—"This splendid ceremony was performed with a pomp and magnificence worthy of the first commercial city in the world. Their most gracious Majesties were pleased to honour the citizens of London with their presence on this occasion attended by the ladies of the Court, the chief officers of the State, &c., &c. The arrangements on the river were confided to Sir Byam Martin, under whose judicious management a channel was kept open for the royal procession by means of vessels and barges moored in two lines extending from Somerset House to the New Bridge. The river was also crowded with steam-boats, the gorgeous state barges of the City companies, and craft of every description, gaily decorated with colours. Their Majesties and suite embarked at Somerset House, in open galleys, at 3 p.m., and arrived at the bridge amidst the applauding shouts of their loyal subjects, the ringing of bells, and the firing of cannon. The Metropolis appeared to have poured forth its population on this occasion: the shores, wharves, warehouses and, in short, every opening whence a sight of the procession could be obtained, were literally crowded with spectators. To complete the *coup d'œil*, the weather was extremely fine, and so excellent were the arrangements that scarcely an accident occurred. On landing, the royal party were received by the Lord Mayor, the Bridge Committee, and City authorities, and conducted to a magnificent pavilion tastefully decorated, and extending over a third part of the bridge, thus forming a capacious banqueting room. Their Majesties having inspected the structure, were pleased to express their approbation of it, and on their arrival at the Southwark end, Mr. Green ascended in an elegant balloon. They then partook of a sumptuous entertainment, during which his Majesty was pleased to propose several toasts, expressive of his good wishes towards the citizens of London. After remaining a considerable time, their Majesties returned in the same manner, and landed safely at Somerset House at half-past six."

All the paraphernalia prepared for the ceremony was then removed, and on the next day, the 2nd of August, the New London Bridge was fairly opened for public traffic. How well it has sustained that ever increasing traffic for the last thirty years is well known, and that it will continue so to sustain it for centuries to come is pretty certain. Before leaving the consideration of this noble specimen of bridge architecture, and advancing to our examination of some other remarkable structures of a like character, it may not be improper to furnish the exact dimensions of New London Bridge, together with some statistics of the material consumed in its erection:—

Centre arch, 152 feet span, 29 feet 6 inches rise above Trinity high water mark.

Arch on either side, 140 feet span, 27 feet 6 inches rise.

Abutment arches, 130 feet span, 24 feet 6 inches rise.

Two centre piers each 24 feet thick.
Two land ditto, each 22 feet thick.
Total lineal water way, 690 feet.
Total length of the bridge, 1,000 feet.
Width of foot-paths, each 9 feet.
Width of carriage way, 35 feet.
Height of parapets, 4 feet 2 inches.
Width of Thames-street arch, 35 feet.

Width of Tooley-street arch, 23 feet.

Height of bridge from low-water mark, 60 feet.

Number of piles, of beech wood, under the piers and abutments, each 20 feet in length, 2092.

Number of tons of stone in bridge and abutments, 120,000.

Weight of four sets of wood centres, 3,200 tons.

Total number of piles in coffer dams, 7,708.

Cost of bridge and approaches, £1,458,34 8s. and 11¾d.

Number of houses removed in making the approaches, 318.

Time employed in the erection of the bridge, 7 years and 3 months.

Average number of men employed daily, 800.

Greatest depth of foundation of centre piers below low water, 29 feet 6 inches.

Such are the particulars in connection with this structure which, at the time of its erection, might certainly be considered the noblest bridge in the world, and which may, even now, be favourably compared with many which, under the advantages of increased engineering and architectural knowledge, have since been erected.

ARTILLERY PROGRESS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I have been waiting patiently for Captain Halsted's reply, believing that it would entirely refute Sir W. Armstrong's arguments, and show the incorrectness of the tabular returns given by him in the *Times* of the 27th of November last. First, I may state that the new 70-pounder manufactured since the articles appeared in the MECHANICS' MAGAZINE, and Sir William's reply, is a totally different weapon from his former finely-grooved gun. It is true that it is intended to fire the objectionable leaded projectiles, but the rifling is different. Wedges instead of the screw and vent piece are used to close the breech, and the vent hole is made in the gun itself, which, unlike its predecessors, has a *muzzle swell*.

Nor is this the only change. A new and short 40-pounder is now in progress of manufacture, to replace the former long guns; so that the whole of the 250 guns of the first pattern, after 70 have been strengthened, and some 30 either had, or having, new tubes put into them, on the Whitworth tapering plan, are practically condemned as "inefficient."

With the 100-pounder the case is still worse; for we have 250 out of the 500 made with the inner tube of a solid forging, a plan condemned by Sir William as "inferior." But both the coil tube and the forged tube have already had to be replaced by new tubes, put in on the tapering plan. So unsatisfactory, however, has the coil system of inner tubing, which Sir William claims as "his own principle," hitherto proved, that brass tubes, which have been substituted for the coil, are now under trial with both a 40 and a 100-pounder!

If we turn to Sir William's patent, however, dated February 11, 1857, we find the following in the Abridgment of Specifications:—"It is proposed to form a gun with an internal tube of wrought iron or gun metal, with cylindrical casings of wrought iron or gun metal shrunk on." We ask, therefore, when did the inner coil tubing of the Elswick guns become Sir William's principle, and the forged tubing of the Arsenal guns not his principle? We may soon expect to hear that the screw and vent piece, almost universally condemned by artillery officers, especially for large guns, was not Sir William's principle, but merely adopted from difficulties in manufacture. I state these things, believing that it is far better to at once fully investigate the matter, and know the worst, than to go on bound to the car of Sir W. Armstrong. He has already furnished the nation with 100-pounders, 100-pounder howitzers, 80-pounders, 70-pounders, 40-pounders long, to be followed by 40-pounders short, 25-pounders long and 25-pounders short; and instead of simplifying the ordnance, the gun and its supplies are every day becoming more complicated.

The worst is that none of those guns can take any of the present ammunition; they require a delicate lead-coated projectile, and a slow-burning powder; and to make matters worse, the simple fuses of Petman, which will answer as well for rifle as for the old round shell, have been put aside, while Sir William is trying to perfect a fuse far less simple, though analogous in its action—in fact, the Petman fuse Armstrongized.

Sir William speaks of the Select Committee, but they are entirely under the control of the War Department, and in no way responsible for Sir William's guns—in fact, Sir William goes to Shoeburyness, and makes experiments, without either their concurrence or knowledge.

Sir William has inserted a letter from an officer who was one of the committee of three that recommended the adoption of his gun into the service, another being Captain W. Wiseman, who is the only naval member of the present Ordnance Committee, the Secretary to that Committee having been the officer who afterwards left the Artillery to join Sir William as a partner.

Sir William dwells much upon the latest prices of his guns, and that Government has been guaranteed against injuries in proof. We ask how long has this been the case, and whether it is not true that the contract price given does not include the sighting? And, also, whether the Arsenal factories cannot manufacture the guns at little more than one half of even the *very latest* contract price paid to Elswick?

If this be so, and Sir William is still only experimenting, on a gigantic scale, with 300-pounders, before the 100-pounders have proved a success, is there not reason for urging that a full and searching inquiry be made into the whole matter, and thus avoid even more serious mishaps than we so lately suffered from the break-down in the early part of the Crimean campaign.

ARTILLERIST.

THE NEW BRIDGE AT BLACKFRIARS.

ON Saturday last the report made to the Court of Common Council from the Bridge House Estates Committee, upon the reference to them to obtain designs and estimates for the construction of a new bridge at Blackfriars, and making temporary provision for the traffic, was printed for distribution among the members of the Common Council. After maturely considering the various designs, the committee came to the conclusion that, having regard to the length of time that would be necessarily occupied in the construction of a bridge of stone more than of a bridge with iron arches, and to the facts that the depth required at the crown of the arches of a stone bridge would prejudicially affect the gradient of approaches and roadway of the bridge, and that the cost of a stone bridge was, in all cases, so much more than of those of iron, it was not desirable to adopt a design for a stone bridge. The committee next decided that, as it was essential to preserve the present lines of approach to the proposed bridge, the entire line of the new structure should correspond with the centre line of the existing approaches; and having regard to the great increase of traffic which must be expected consequent upon the formation of new railway stations and termini within the metropolis, and that the bridge should be worthy of the wealth and the position of the City of London, they selected the design of Mr. Page for a bridge of three iron arches on granite piers. They state that no disturbance of the traffic will arise during the construction, that provision will be made for it without a temporary bridge, and that the cost of the works will be £245,000. The estimates of the other engineers who tendered were Sir John Rennie, £410,000; Mr. Cubitt, £245,000; Mr. George Rennie, £210,000 to £270,000; Mr. Brereton, £145,000; Mr. Mylne, 333,250 and £409,250; Mr. Brunless, £84,496; Mr. Bidder, £176,000; Mr. Barlow, £149,372; Mr. Hawkshaw, £850,000; Mr. Fowler, £280,000. Mr. Page, Mr. Hawkshaw, and Mr. Bidder proposed to make the bridge 80 feet wide; Mr. Barlow 72 feet; Mr. Mylne, 68 feet 5 inches; Mr. Brunless, 70 feet; Mr. Rennie, 60 and 70 feet; Mr. Brereton, 58 feet; Mr. Greenhill, 60 feet; and Sir John Rennie, 64 feet 4 inches. The bridge selected by the committee is described in the report as remarkable for its grandeur of style and beauty, and as worthy in all respects of the city of London. The centre arch is 280 feet span (40 feet wider than the centre arch of Southwark-bridge), and the two side arches being each 220 feet span, the water way being thus 720 feet, the two piers are each 28 feet in thickness. The springing line of the arches is 2 feet above Trinity high water mark (the tide having, on extraordinary occasions, risen 3 feet 8 inches above that datum). The rise of the centre arch above the springing is 24 feet, and of the side arches 20 feet; hence the headway at Trinity high water will be 26 feet under the centre arch, and 22 feet under the side arches. The structure of the arches will be in cast iron from the piers to within 40 feet of the crown; the centre piece forming the key of the arch, 80 feet in length, being of wrought iron; so that the thinnest part of the bridge, which is in immediate contiguity with the roadway, and consequently subject to any shocks from the traffic, would be of the most safe material.

The four pedestals on each side of the bridge, 40 feet in height above high water mark, and 23 feet in width, would supply bases for groups of sculpture commemorative of past events in our national history, in some of which the chief magistrates of London took an active part. Those indicated in the drawing are intended to represent King Alfred, Boadicea leading to the charge, Sir William Walworth dealing the death blow on Wat Tyler, and our present sovereign, Queen Victoria, encouraging the arts of peace. These groups, placed so high as to have a sky outline, would offer to the observer a series of sculpture in a position unequalled in this country, as they would be separate and distinct from all surrounding objects, and would stand out in bold relief an ornament and an honour to the city of London.

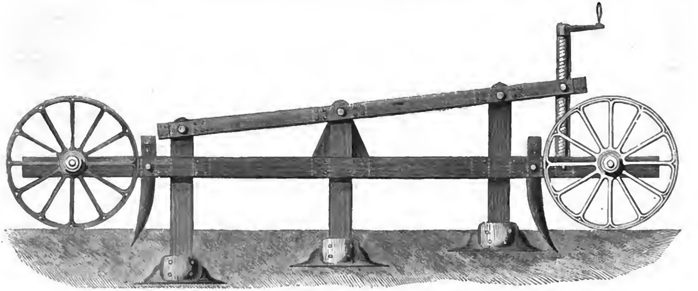
The foundation of the bridge is proposed to be formed on timber and iron piles, similar to those of Westminster-bridge, and the materials of construction are to be piers of masonry, on pile foundation and iron, wrought and cast iron in arches and superstructure. The time of construction is stated at two years and a-half, and provision is to be made for the traffic without the erection of a temporary bridge, as has been the case at Westminster.

THE OIL SPRINGS OF AMERICA AND CANADA.

MR. ALEXANDER MACRAE, oil and produce brokers of Liverpool, in a circular, dated 16th December, says:—

"The introduction of petroleum, kerosine, photogene, or rock and well oil, is making tremendous strides, though it does not surpass the prediction in my first circular, namely, that it would be second only in extent to cotton. I will even go a step further, and venture to assert that if the rocks and wells of Pennsylvania, Canada, and other districts, continue their exudation at the present rate of supply, the value of the trade in this oil may even equal American cotton. Mon-

J. AND F. HANCOCK'S PATENT PULVERISER.



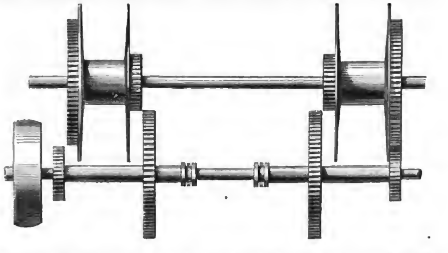
treal (internally, and likely externally by this time) is lit with the white refined, and I can see no reason why London and Liverpool should not also be, for the oil gas distilled from the raw petroleum is immensely superior, and much more brilliant than our own coal gas. For years we have sent coals to America for gas-works, and it will be a singular freak of events if she and Canada should now supply us with a better expedient. Invested interests will, perhaps, stay it for the moment, but will they ultimately?

"The refined for burning (known in this country as paraffin oil, and of which about 500 tuns a week are sold), has been selling at £30 to £40 per ton (of 252 gallons) for yellow to white, while the crude varies in value from £6 to £25, according to test. The merits of the petroleum will be better understood, when importers are informed that besides the uses already named, lubricating oils of every colour and specific gravity can be obtained from it; wax, also, for the manufacture of paraffin candles, naptha, and consequently benzole (from which the fashionable dyes, magenta, rosenine, anneline, &c., are obtained), pitch, &c., &c., all of them having several other applications. It is reported on the very best authority, that they have discovered from it now, an available substitute for spirits of turpentine for paints, and also a solvent for india-rubber, results, I understand, that they have not effected in America or Canada, and the importance of which cannot be over-estimated.

"In my first circular it was stated that some 7,000 barrels of crude and refined were on the way to this country, and the *Times*, of the 13th inst., mentions 8,000 barrels on the way to London. There are 10,000 barrels coming to Liverpool, and 2,000 barrels to Glasgow, in all about 20,000 barrels (or £100,000 sterling, and the trade not six months old), a simple tithe of what we want; American hostilities and the ice in the St. Lawrence (although we have still St. John's, New Brunswick) may stop supplies to some extent, but I have no doubt the future will vindicate the expectations I have so frequently expressed."

J. & F. HANCOCK'S PATENT PULVERISER.

IN our review of the cattle show of 1861, held at Baker-street, we laid great stress upon a new pulveriser recently invented by Messrs. J. and F. Hancock, and we now take the opportunity of illustrating it. The new pulveriser is constructed upon the principle of placing the shares step-wise, that is, the first share ploughing a few inches below the surface, the second somewhat deeper, and the third deeper still. The utility of this



system is evident even to the inexperienced, as the first share will enable the soil to be turned over, thus facilitating the disposal of the old surface with the manure at the proper place, namely, a few inches below the new surface. The merits of this system have been dilated upon before in our pages, and we wish now to show its application to steam culture. It will be seen in the above illustration, that the shares or tools are suspended from a longitudinal oscillating beam. To enable the tools or shares to cut in both directions, they are furnished with a double cutting edge. One end of the beam is connected with a screw, by which it is operated on, and the depth of cut regulated. When the pulveriser arrives at the headland, the tool which was deepest now becomes the shallowest, thus enabling the machine to travel the reverse way.

Another of Messrs. Hancock's inventions is a drum, or drums, for working the rope or chain for drawing ploughs and other implements. The drum or drums are mounted upon an axle fitted to the back of a portable engine, and by means of toothed gearing, the speed is increased or slackened to enable the engine to exert its whole power in drawing the implements over stiff land or where any rise in the ground may occur. The second engraving illustrates this method. It will be seen by the engraving, that the slow motion is in gear on the drawing drum, the other being thrown out of gear to give off the slack, which in the reverse course is thrown into action. When the ploughs are travelling on level ground the fast motion is made. Thus the speed of the implement can be regulated without straining the engine to the alarming extent as is now frequently the case.

RAILWAYS IN HOLLAND.

THE following communication has been received from M. J. W. Del Campo, of Holland:—

"Railways may now be regarded as necessaries of life, and, however high were the expectations of the invention of Stephenson, we have not been disappointed; on the contrary, wherever the steam locomotive has appeared, prosperity has increased, isolation and ignorance have given way, traffic and civilization have advanced. It is astonishing, therefore, that this valuable means of communication is not more generally used in some countries, so as to increase still more considerably their commerce and industry.

"How was it that a country like Holland, generally known and highly-esteemed for its trade and industry, did not avail itself of railways, so as to keep pace with the general progress in other countries?

"Its most flourishing provinces, where the cultivation of the soil and the breeding of cattle have made great progress, are completely separated from the general means of communication; their products are sent to the nearest harbour to be embarked for the great metropolis of the world while persons travel by stage coaches, like those used half a century ago in England.

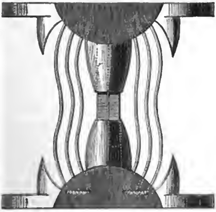
"The great inclination of the people for water communication, the great difficulties of constructing railways over rivers and arms of the sea, which penetrate the country and form many islands; the fact that their construction could not be a profitable enterprise for any private company, and the hesitation on the part of Government to undertake their construction itself against the rules of a sound policy, may account in some way for this. However, these are not to be considered as valid reasons for being deprived of railways, and if they are now considered advantageous, why were they not so ten years ago? When the nature of the country made private companies hesitate to construct them, why should not the Government have done it? There are, indeed, very few railways which have been profitable to the companies, but who can tell how many millions they have increased the wealth of the people, or how much they have contributed to their civilization and welfare?

"I am glad, however, to be able to say that railways are now being constructed in Holland. The Government is making use of its able civil and military engineers to overcome the difficulties of crossing the rivers, and has in view the carrying out of a complete railway system within ten years. There will be constructed about 900 miles of railway, at an expense estimated at £7,000,000, of which a third part is to be expended on railway bridges only. These Railways will unite the following towns:—Amsterdam, Hague, Rotterdam, Breda, Maastricht, Utrecht, Arnhem, Zutphen, Atsen, Harlingen, New Diep, and others.

"Besides the railway, a canal will be made to unite the capital, Amsterdam, immediately with the ocean.

"This railway system will be beneficial to the country, the production of the soil and of industry increasing in proportion as the means of communication improve, and will be at the same time of much importance to Great Britain. The commercial towns of Holland will thus be brought nearer to England's sea ports, and the intercourse will be greater. It must be beneficial to both countries, whose histories are so connected with each other. In the great battle for liberty, they have both marched in the same course; in the promotion of commerce, they have both shown themselves energetic and successful. May they always work together to promote civilization, to cultivate peaceful sentiments, and increase the welfare of their populations."

WATSON'S CARRIAGE SPRINGS.



THIS invention, just patented by Mr. A. T. Watson, of Middleton, New York, consists in placing plates of steel vertically in suitable frames, as represented in the above engraving. The plates forming the spring are curved and of different lengths, so that when pressure is applied, one set of plates shall be acted upon before the next set, the others being brought into action as the pressure is increased. Thus, the elastic force will be gradually and progressively exerted, the spring thereby graduating itself to the load.

CLARK'S IMPROVEMENTS IN FURNACES.

FIG. 1.

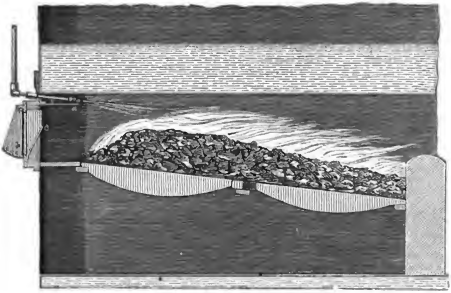
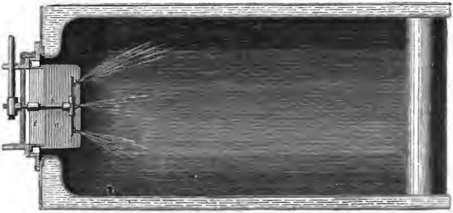


FIG. 2.



CLARK'S IMPROVEMENTS IN FURNACES.

Mr. D. K. CLARK, of 11 Adam Street, Adelphi, Engineer, proposes to admit jets of steam into the furnaces of locomotive and other boilers, in order that the fuel may be burned with more advantage and without emitting smoke, the steam being admitted at the upper part of the furnace and over the door. Below the jets of steam, a plate or partition is fixed in such a manner that any air passes beyond the interposed plate or partition, which protrudes some distance into the furnace. It is preferred that the door should on the interior have an inclined plate rising from the lower part thereof; the space between it and the door is closed in at the ends, so that any air admitted through or at the door, may not pass directly into the furnace, but be caused to rise up in the space formed between the inner surface of the plate or partition interposed between the jets of steam and the door of the furnace.

FIG. 3.

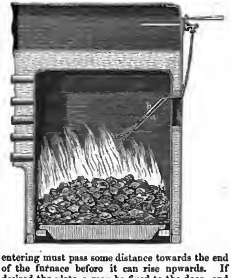


Fig. 1 above shows a longitudinal section, and Fig. 2 a plan in section of a furnace suitable for a fixed steam-engine boiler, Fig. 3 shows a vertical section of the fire-box of a locomotive. Above each of the fire-doors of the furnaces there is affixed a plate *a*, by which any air which may enter at the fire-door will be prevented rising directly upwards, but on the contrary, the air so entering must pass some distance towards the end of the furnace before it can rise upwards. If desired the plate *a* may be fixed to the door, and be moved in and out by it. Above this plate *a*, and in the space thus enclosed above the door, there is a steam pipe *b*, arranged with suitable jet pipes or nozzles, in order that jets of steam may be introduced above the fuel in the fireplace;

c is an inclined plate attached to the lower part of the door; this inclined plate may be hinged so as to admit of being adjusted.

ON THE PROSPECTS OF CLASS I. IN THE INTERNATIONAL EXHIBITION OF 1862.

By ROBERT HUNT, F.R.S.

IN 1850 there was considerable discussion on the question of including native mineral produce in the Great Exhibition of 1851, which many persons thought should be confined to manufactures. The discussion eventually terminated in the formation of Class 1, devoted to Mining, Quarrying, Metallurgy, and Mineral Products.

Her Majesty's Commissioners for the International Exhibition of 1862 have come to a similar determination, the only difference being that Class 1 is now considerably extended, and several mineral and metal manufactures are embraced by it. There is great difficulty in knowing where to draw the line, and much confusion would arise in the arrangement of so large a collection of industrial products, unless some latitude was allowed. With mining and quarrying a tolerable degree of exactness might have been observed. The ores as raised from the earth, and the stones as broken out of the rock, with the appliances for facilitating the labours of man in those dangerous and difficult operations, would have been alone comprehended. Metallurgy opens a wide door, and we scarcely know when to close it. It may be said that the metallurgy of iron ends with the production of the pig-iron; but, is not a casting direct from the furnace, although it may be highly ornamental, as much a metallurgical process as the development of an ill-shaped pig? The production of a bar of iron or of a sheet is considered fairly a metallurgical operation, but it is not clear why a rolled rail is not equally so. Beyond this, in the Exhibition we have to deal with the dislike of the exhibitors to separate their manufacturing productions one from the other? Hence, in many cases, the unmistakeable results of handicraft will be seen in connection with the products of the furnace.

Similar remarks apply to purely mineral products, and the visitors to this class, during the coming summer, will not be displeased to see many beautiful examples of workmanship in the stones and marbles of our own country, in contact with our native products in their crude state.

* * * * *

It is now time we should say a few words on the prospects of Class 1, and its promise in comparison, especially, with the great Exhibition of 1851, and, incidentally, with the Paris Exhibition of 1855. That division of this class in which will be represented the metalliferous minerals of the United Kingdom will be of considerable commercial interest.

The lead hills of Lanarkshire, once the scene of a wild rush after gold, and always a district producing rare minerals, will send a series of their treasures. Lead ores and their products are coming from Durham, Northumberland, and Cumberland. The mountain limestone regions of Yorkshire will furnish lead and copper, and Cardiganshire and Flintshire will exhibit varieties of their galenas and blendes. The local committees of Exeter, Tavistock, and Redruth, are carefully looking up the more remarkable examples of the minerals of Devonshire and Cornwall. That tin ore which has been worked in Cornwall and on Dartmoor for more than two thousand years, and which is now being obtained at the rate of ten thousand tons per annum, will be shown as obtained from the stream and from the mine. Several varieties of copper ore, many of the rich argentiferous lead ores of the west, the zinc ores of these counties, the sulphur ores (iron pyrites) and many others, not quite so important, but remarkable as being rare, are to be amongst the illustrations of nature's bounty to us. Ireland, too, sends over her lead, copper, and pyritic ores.

Although the Exhibition of 1862 will not exhibit such a complete collection of iron ores as the industry of Mr. S. Blackwell brought together in 1851, yet most of the new discoveries, and they are many and important, will find a place. The iron ores of Weardale, those of Cleveland, and the recent discoveries in the West Riding of Yorkshire, the remarkable deposits of Lincolnshire, those of the Midland Counties, and the best examples from Somerset, Devon, and Cornwall, will form an interesting series. Amongst the metalliferous minerals, examples of gold from Devonshire will be found; but of the more important gold quartz of Merionethshire we hear nothing.

Coals promise to be abundant. There is scarcely a useful seam from which an example will not be sent. In 1851 there were some gigantic blocks, many of them of little interest, and showing no more of the quality of the coal than would have been shown by a smaller specimen. We hear but little of such masses now. Two or three exhibitors desire to show the entire thickness of the seam they work, and a very few have some peculiarity which can only be seen in a mass of good size; cubical pieces of about eighteen inches will be the rule. In most cases, the local committees have endeavoured to prevent reduplication, and, in others, the specimens to be exhibited have been determined by the Coal Trade Associations.

Of the earthy minerals there will not be a large display. Fuller's earth, barytes, chalk, sands for glass making, and polishing powders are, however, amongst the lists of things for which space has been applied for.

Dorsetshire sends its celebrated Potter's clay, and from the neighbourhood of Newton Abbot, in Devonshire, several examples of the so-called "Teignmouth clay," (because it is shipped from that port), and specimens of articles manufactured from it, will be exhibited. The kaolin, or porcelain clay, of Dartmoor, and from the extensive clay works around St. Austell, in Cornwall, will form an interesting series. The fire clays of the coal measure districts of the Midland and Northern Counties, with gas retorts, glass-house pots, and other manufactures from them, will be fully shown. Here, as in many other divisions, there arises what we may term an overlapping of the classes. Class 35 is devoted to pottery, and should include all the manufactures, but many of the exhibitors prefer placing in Class 1, with their clays, the articles made from that material. Melting pots and crucibles have been placed in Class 35; but the makers of them, regarding them as purely metallurgical, prefer seeing them in Class 1.

The building and ornamental stones of the kingdom promise to be fully represented. The sandstones of the coal measures of the North; the dolomites of Yorkshire and the neighbouring counties; the Liassic limestones, the oolites, especially those from the neighbourhood of Bath; Portland stone, Purbeck marble, Stonesfield slate, and numerous other varieties, will illustrate our richness in the materials of construction. Granites, from Scotland, from Leicestershire, and from Cornwall, will form prominent objects, since many large examples will be elaborately wrought, and some of them highly polished. The Serpentines of Cornwall, certainly the most beautiful ornamental stone of these islands, will be exhibited in some new and interesting forms. The Irish serpentine, or Connemara marble, will also form a striking object.

The true marbles of Devonshire and those of Derbyshire will come forth prominently. Several tables are manufactured from them; and ornamental vases and other things have space reserved. We learn that the vases made from the black marble of Derbyshire will be of unusual size and great elegance.

The Port Madoc local committee promise a good series of slates and slabs, while the Llangollen quarries will send one of the largest slabs ever got out of a quarry. The articles, such as chimney pieces, tables, &c., manufactured from slate, and enamelled, will be numerous.

Many models illustrating mining operations are in progress of construction, some of them of large size, and very instructive. Sectional models, as of the iron deposits at Whitehaven; of the copper and tin lode at Dolcoath, in Cornwall, made from the rocks themselves, and thus showing the actual conditions, will add greatly to the interest of this section. Models of plans for ventilation; models of safety cages, and actual safety cages will be shewn, as will also several machines employed in "dressing" the metalliferous ores for the market.

From this rapid sketch it will be evident that the mineral produce of the country will be fairly illustrated.

In metallurgy, the examples of iron will be numerous, and, at the same time, as nearly all varieties of pig iron will be found in the Exhibition, there will be some of the most remarkable examples of rolled iron that have ever yet been shown. Rails from 60 to 100 feet in length without a weld; bars of remarkable size and length; sheets of iron of most unusual dimensions; and armour plates, which have resisted the battering power of Armstrong's guns, will be there. Cranks, one weighing above 20 tons, and beams of singular size and strength, will prove the capabilities of British forges. Tin plates will be well illustrated, but the smelters of tin are not patriotic enough to aid in this industrial movement, and unless the Redruth Local Committee persuades a Cornish smelter to exhibit, the most ancient metallurgical process of the country will not be seen.

The metallurgy of copper, on the contrary, will be fully illustrated, as will that of zinc, lead, and silver, with the refining of cobalt and nickel. Even gold, platinum, and other precious metals, will be shown in their processes of refining and the like, tin alone being unrepresented. Space has been secured by exhibitors, perhaps not so much as they may have desired, but still, we hope, ample for the exhibition of the more striking objects. Let us hope that there will be a unanimity of feeling amongst them, and that in the difficult task of arrangement there will be shown an accommodating spirit. It would be in the highest degree desirable, if the exhibitors could, by communicating one with the other, obviate that reduplication of articles which will possibly arise if each one works in ignorance of the plans of his neighbour. Every one is aware that the manufacturer looks to an exhibition of this high character as a means for making him better known to the world, and it is intended that this should be one of the objects. But let it never be forgotten that the great end in view is an educational one. We are to learn, from the works of other countries, to improve our own manufactures, and in return, we are to impart to the strangers who visit us, information which will be valuable to them. By the collision of minds new truths are developed; by an industrial contest fresh powers are called into play, and the world is benefited by the production of something which either adds to the pleasures of existence, or ministers to the necessities of man.

Proceedings of Societies.

CIVIL AND MECHANICAL ENGINEERS SOCIETY.

Thursday, Dec. 19,—Mr. Charles B. King, M.E., in the chair.

"ON THE THEORY OF STEAM AND OTHER HEAT ENGINES." By Mr. Francis Campin, C.E., President. THE author opened his remarks by directing attention to the small progress which had been made in the steam engine during the last half century, with regard to economy of action, in comparison with what might reasonably be expected from the vast strides which had characterized the advance of physical science. It appeared to him that the true bearing of physical science upon the steam-engine was not yet perfectly understood, and that in the entire comprehension of the nature of physical force and its transmutation, consisted the knowledge requisite to enable us to arrive at the means of constructing Thermo-motive engines, capable of exhibiting a high degree of efficiency.

The object of the paper was, therefore, to raise a discussion upon the generally-accepted theory of Thermo-dynamics, according to which the mechanical equivalent of heat is 772 foot pounds per unit, that is to say, that the heat required to raise one pound of water one degree Fahrenheit is capable of producing 772 foot pounds of work. Calculating upon this datum, the efficiency of the best steam-engine will not exceed one-ninth. It is very important to determine the cause of this low efficiency, whether it be in the medium employed, or in the mechanical arrangements, or whether the theory be erroneous. It is necessary now to examine the circumstances attendant upon the production of motion due to the disappearance of heat, and most important to determine whether the heat is actually annihilated or not. If a cubic foot of water be evaporated against the constant resistance of the atmosphere, about 3,454,000 foot pounds of work will be executed, with the disappearance of 62,500 units of heat; but this is not the greatest amount of work which may be got out of that quantity of heat. Let the water be confined until the whole of the 62,500 units of heat is communicated to it, then allow the steam to expand against a resistance varying from the greatest pressure (24,000 lbs. per inch) down to the ordinary atmospheric pressure, and then about 2,600,000,000 foot pounds of work will be performed, if no heat dissapears except that which becomes latent, and which may subsequently be recovered by condensation, and this quantity of work is much in excess of what should be obtained according to Dr. Joule's equivalent.

The foregoing results appear to indicate the inefficiency of Joule's formula, and the calculations seem accurate, as we find that we can, by pursuing a similar course, calculate the amount of work executed by any steam-engine, without the risk of considerable error

If a quantity of heat proportional to the work done be actually annihilated, either the temperature of the whole bulk of steam in the cylinder must be thereby reduced, or a portion of the steam must be condensed, in which case it is a matter of considerable difficulty to explain the *modus operandi* of steam in producing motion, nor does it appear that actual proof of such destruction of heat exists; the conclusions arrived at are, therefore, that work is obtained by the absorption of heat by the expanding steam, and that the heat may be recovered by condensation.

The author next proceeded to explain the advantages attendant upon the employment of high pressure steam, with a considerable degree of expansion, and to show that the experiments of Thiners and Isherwood, upon the practical utility of the method of expansion, were quite useless, and that the results arrived at by means of those experiments were applicable only under the circumstances which attended their performance.

In the opinions expressed in the foregoing words, the author was almost singular, but was in some measure supported by the researches of Seguin, and they were also similar to those expressed in Joseph Gills' "Essay on Thermodynamics," published by Weale, 1861.

The relative efficiency of the steam-engine and various forms of air-engines was then entered upon, the result, showing that the economy of the latter was not nearly so great as is generally supposed; and that an engine by Siemens was the only one which exhibited a well marked superiority over the steam-engine. He concluded, by returning cordial thanks to Messrs. Braithwaite, C. W. Siemens, E. E. Allen, and others, who had supplied him with information.

The paper was followed by a very interesting discussion, in which the Chairman, and Messrs. R. Howson, E. Field, Wellington Lee, W. Gill, C. G. Gumpel, and the Author took part.

THE NEW LONG TUBE BAROMETER.

Dec 19.—Mr. Richard Howson exhibited and explained his patent Barometer, which on account of its exceeding delicacy of action excited general admiration. In this barometer the tube is surrounded at its lower extremity by a larger tube, free to slide vertically upon it, and which forms the mercury cistern. To this cistern is attached a closed glass tube, which passes within the barometer tube, leaving between the two a small annular space. The atmosphere acts upon the bottom of the cistern, the *modus operandi* being as follows. Let us suppose the whole area of the tube to be one square inch, then if the pressure of the atmosphere be increased one inch of mercury, one cubic inch will pass from the cistern into the tube, but it will there have to occupy the annular space existing between the inner surface of the barometer tube and the outer surface of the closed tube within the same; hence it is evident that its vertical rise will greatly exceed one inch, and thus is furnished a means of measuring with a very considerable delicacy, small variations of atmospheric pressure attendant upon meteorological changes, and this is accomplished by an instrument possessing at the same time extreme simplicity of construction, whereby liability to disarrangement is totally obviated.

MEETINGS FOR THE WEEK.

Mon.—*London Inst.*, "On the Physics of Imponderable Matter," by Rev. A. Bath Power, M.A., at 7.
Tues.—*Royal Inst. of Great Britain*, "On Light," by John Tyndall, Esq., F.R.S., at 3 p.m.
Wed.—*Geological Society*, I. "On the Carboniferous Limestone and Yellow Sandstone of Farlow and Oreton, Clee Hills, Salop;" by Professor J. Morris, V.P.G.S., and Mr. G. E. Roberts; with a note on "A New Species of Pterichthys;" by Sir P. Egerton, V.P.G.S. II. "On some Fossil Plants, showing Structure, from the Lower Coal Field of Lancashire;" by E. W. Binney, Esq., F.G.S., at 8 p.m.
London Inst., "On the Geographical and Geological Distribution of Organized Beings;" by E. W. Brayley, Esq., F.R.S., at 7 p.m.
Thur.—*Royal Soc.*, at 8.30 p.m.
Antiquaries, at 8.30 p.m.
Fri.—*London Inst.*, "On the General Phenomena of Chymical Action, and the Laws which Govern them," by Henry Letheby, Esq., M.B., &c., at 7 p.m.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

STEERING SHIPS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I must ask you to allow me to correct Mr. Roberts: I have not said one word against steering by *a* transverse propeller, I merely object to *his* mode of carrying it out. The rudder is itself a transverse propeller. Mr. R. finds in my three letters only *three words* to quarrel with, I presume, therefore, that he considers the rest of my arguments beyond dispute. I believe I have given more thought to his propeller than he has himself, for when it first appeared in your pages I tried to make it practicable and could not.

As the subject is too important to be allowed to rest, I hope to find leisure shortly to resume it.

Returning Mr. R. the compliments of the season, with all my heart, and reminding him that I shall still continue to 'call a spade a spade,'

I am, Sir, yours very obediently,
T. Moy.

1 Clifford's Inn, 30th December, 1861.

AN IMPROVEMENT IN THE KALEIDOSCOPE AND COLOUR-TOP, OR ANY OTHER INSTRUMENT FOR PRODUCING COLOUR BY ROTATION.

Sir,—If the pieces of glass used in a kaleidoscope were cut in various regular forms, the effect of the instrument would greatly be improved, and this by means of the duplication of symmetry and evenness, which can readily be understood by all who have a competent knowledge of it.

Every apparatus or instrument for producing colour by the rotation of coloured surfaces would be improved if a conical glass vessel, the upper part of which is silvered, were fixed upon the spindle with its apex downwards, in which a number of pieces of various coloured glass were placed, and underneath it a mirror were fixed, which could be placed at a proper angle. Upon the spindle being rotated, the pieces of glass would, by centrifugal force, be carried towards, and in some cases against, the internal parts of the cone, and be illumined by the mirror beneath, and (*i.e.*, some of the rays proceeding from them), reflected from the silvered parts of the vessel. The effect produced would be a very beautiful one, a number of concentric coloured rings being visible, the colour, size, and arrangement of which would in every case be different, the phenomena obtained being infinitely variable. Another improvement would be made if the coloured discs were bent upwards, and, when in motion, looked at across or horizontally, the eyes being at their level, and the blackened disc, of course, removed, in which case, coloured bands would be seen, arranged in vertical rows.

I am, Sir, yours faithfully,
J. Alexander Davies.

December 24, 1861.

TO CORRESPONDENTS.

Received.—W. T., J. H. B., J. N., S. Bros., R. and S., J. V. M., B, and O., N. and Son, C. W., J. B. B., G. H., T. W., J. W. S., W. T., J. N. H., A. R. M., R. P. and Co., S. D., F. R. S., Com. S., J. H.

New Iron Peach Houses at Scone Palace.—We have pleasure in mentioning, at the request of Messrs. J. B. Brown, of Cannon-street, that these new Peach Houses, described in the Magazine, December 27th, were designed by Mr. John Halliday, head gardener at Scone Palace.

Scientific Gossip.

New Paddle-Wheels for the Great Eastern.—We learn that to Messrs. Brotherhood, of Chippenham, is intrusted the construction of new paddle-wheels for the above-named leviathan steamship. The diameter of the wheels over all will be 52 feet, their width 13 feet, and the depth of the floats, which will be formed of stout beech, will be 2 feet 9 inches. The greatest despatch is to be used in the preparation of the new wheels, and to insure this, perhaps, no better firm than that of Messrs. Brotherhood could be named. The new paddle-wheels will be in every way materially stronger than those with which the Great Eastern was originally furnished.

On Saturday next, to morrow, the election of a chairman, vice-chairman, and other officers of the Association of Foremen Engineers will take place.

The Swedish Government last year sent a scientific expedition to Spitzbergen. It has just returned to Troruss, whence it started, after having accomplished its mission very satisfactorily, in spite of the extreme rigour of the weather. The old maps have been corrected; fresh ports have been discovered, and numerous experiments made, which have thrown fresh light on meteorology and natural history. It has been ascertained that animal and vegetable life exist in the sea at a depth of 2,500 yards, and that the great current of the Atlantic Ocean, known by the name of the Gulf-stream, reaches as far as the coast of Spitzbergen, pieces of broken wood, bottles, &c., having been found there.

W. C. S., in a communication on the poisonous nature of dead branches of the yew tree, says:—A fine old edge of yew had been ordered to be trimmed, and the labourers, knowing its poisonous properties, carefully collected the trimmings; but, removing them, as it were "out of the frying pan into the fire," placed them in a ditch to which the cattle had access, and the beasts devoured the clippings eagerly, and were speedily destroyed. And now, passing over various other instances, a lady residing not many miles from the same locality writes, that a valuable heifer, half an hour after eating the yew died, and the presence of the yew leaves in the paunch points to the cause of death. She wishes to know whether the poisonous effect is confined to the male or non berry tree, as is frequently supposed to be the case, and would like to know from analysis where the poison resides. It is the leaves that are devoured, and which prove poisonous, and there is no reason whatever for the idea that there is any difference between the two trees, or that the poisonous quality is confined to the one or the other. It no doubt resides in some essential oil common to both, and should teach the absolute necessity of treating the trimmings of yew trees or hedges as poison itself. And as no chemist is permitted to sell poisonous drugs without proper labels, so no countrymen should ever be allowed to leave the trimmings of the yew exposed for a single hour in any spot to which cattle have access, but should be instructed to consign them to the flames as promptly and certainly as he would destroy the viper which crosses his path. It may also be seriously recommended that when yews are not required, either for ornament or utility, they should be removed and destroyed.

Ingenious Mechanism.—During the Christmas vacation, Mr. Osborne, the well-known provision dealer on Ludgate Hill, exhibited in his window a novel application of water power; complete models of a well arranged dairy-farm, representing the various processes for the production of butter, cheese, bacon, &c., and each operator busily employed. The water-tank from which the hydraulic power was obtained which set all this in motion, was concealed in a cottage of a rustic character. Added to the attributes of the farm there were several very cleverly arranged accessories; volunteers were made to march in time over a bridge, and disappearing, appear again with the numerical economy of a minor theatre. A splendid trout stream, fretted, gurgled and dashed down the estate, and found for awhile a quiet resting place in an artificial lake, where a fountain disported and renewed the oxygen which gave additional vigour to the tiniest of minnows, which we were pleased to consider as salmon, or trout, at least. Nor was the great power of water as steam unrepresented, for an admirable model of a locomotive engine ran with unusual regularity from terminus to terminus without an accident. Although the whole affair was doubtless "got up" to attract customers, it was certainly a most ingenious and pleasing instance of how much can be done in a comparative small space, and moreover had its educational tendencies in the science of hydrostatics.

A monument to Sir Humphrey Davy, which will include a bronze statue, is about to be erected at Penzance. The idea originated with the working men of that locality. No one could be more deserving of such an honour than the inventor of the Davy lamp.

Aberdare Colliery Company.—A prospectus has been issued of this company, with a capital of £100,000, in £10 shares. The object is to purchase and work certain collieries, comprising 800 acres, in Glamorganshire, with railway access to the port of Cardiff. The coal produced in this district is especially adapted for steam purposes.

Atmospheric Disinfection.—Dr. Stenhouse, in a letter to the "Society of Arts Journal," says:—From time immemorial it has been a well-known practice to light large fires in marshy and other districts, in almost every quarter of the world, as it has been invariably found that this proceeding produced a very beneficial, though temporary, effect on the salubrity of these districts. This result has hitherto been attributed to the influence of the heat evolved, by which a strong current of air is induced, and consequently, the stagnant atmosphere is set in thorough circulation. Now, however, that the absorbent and oxidising effects of charcoal on deleterious gases and vapours are so well understood and generally admitted, I think the true cause of the beneficial action of great fires in such situations is owing to the large quantity of minutely divided charcoal, which in the shape of smoke, is carried up into the atmosphere. These particles of charcoal absorb and destroy the deleterious gases. Since this is the case, I think it is clear that the object in these operations ought to be to make as much smoke as possible, and that green wood, or other moist fuel, will be found the more suitable substance for this purpose.

Address of Condolence to Her Majesty.—The following address of condolence has been forwarded to the Secretary of State for the Home Department, for presentation to Her Majesty:—*To the Queen's Most Excellent Majesty.* "We, your Majesty's most dutiful and loyal subjects, the Society for the Encouragement of Arts, Manufactures, and Commerce, incorporated by Royal Charter, humbly approach your Majesty, with the assurance of our devoted attachment to your throne and person, and of our respectful sympathy with your Majesty in the great affliction which has so unexpectedly befallen your Majesty and the Nation, in the early death of His Royal Highness the Prince Consort. Whilst the death of a Prince, distinguished by rare intellectual gifts and eminent virtues, is deeply lamented by all classes of your Majesty's subjects, his loss is especially deplored by this Society, which has for many years enjoyed the great advantage of his judicious counsel and support. His Royal Highness was elected President in 1843. His high position, his refined tastes, his enlightened judgment and his candour; his great command of general principles, and his power of applying them to details; and his special knowledge on a great variety of subjects, extended the influence and greatly promoted the objects of the Society. Science, Art, and Literature were, by his judicious patronage, constantly introduced to the notice and recommended to the favour of your Majesty. The great conception of the Exhibition of 1851, with its countless influences on the progress of human industry was due to His Royal Highness, and in overcoming the difficulties of such a new and gigantic work, he solved the problem of conducting future Exhibitions, and their success will be an ever-recurring memorial of their author. The Society can never forget the obligations which His Royal Highness has conferred on them, and they humbly express a hope that the recollection of his virtues and of his public services may, with God's help, in some measure soften the intensity of your Majesty's affliction. That your Majesty may long reign over a loyal and devoted people, is the prayer of your dutiful and loyal subjects and servants. By order of the Council, sealed with the seal of the Society for the Encouragement of Arts, Manufactures, and Commerce, this twenty-seventh day of December, one thousand eight hundred and sixty-one, in the presence of P. Le Neve Foster, *Secretary.*"

Scientific Jottings.—Some time ago a quantity of shrimps were received at Paris from Antwerp, and the singularity of their colour, a deep red, having attracted the attention of the police inspector of the markets, they were seized and sent to MM. Caventore, and Perrot to be analysed at the Laboratory of the Faculty of Medicine, where it was soon found that the suspected shrimps had been most clumsily painted with red lead, about the easiest substance to discover that could be selected. It appears from the entries of the Custom-house Department of the United States, that 300,000 lbs. of opium had been imported during the year 1860. Of this enormous quantity it is calculated that scarcely one-tenth has been used for medical purposes, so that the remainder must have been consumed in the preparation of intoxicating drinks. Lawyers, clergymen, and even physicians, across the Atlantic, are said to indulge largely in opium eating. Professor Mitscherlich gives the following analysis of 100 parts of Guayaquil cocoa:—From 45 to 49 of butter, 14 to 18 of starch, 0·34 of glycose, 0·26 of cane sugar, 5·8 of cellulose, from 3·5 to 5 of colouring matter, from 13 to 18 of albuminoid matter, from 1·2 to 1·5 of theobromine, 3·5 of ashes, from 5·6 to 6·3 of water. Theobromine, our readers will recollect, is the active principle of coffee, tea, and cocoa, which therefore all exercise, more or less, the same action upon the human frame, differing from each other only in flavour. Dr. Wilhelm-Pitschner of Berlin, has been requested by the Prussian Government to make an ascent of Mont Blanc for scientific purposes. The doctor, who has already performed the feat once before, is this time to pass at least a fortnight among the ice fields, and to be accompanied by twenty guides, including a member of the celebrated Balmat family, whose ancestor was dubbed "Jacques Balmat du Mon Blanc," by the King of Sardinia, on account of his great intrepidity. Dr. Pitschner is to be moreover provided with numerous instruments, and a waterproof tent to be deeply imbedded in the ice, in order to bid defiance to the mountain storms, and protect the travellers from drift-snow, which is so common in those regions. Astronomical as well as microscopic observations, and experiments on the increase or diminution of ice and snow at great elevations, are to engage the doctor's attention.—*Galignani.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., *None.*
Boilers and their Furnaces, &c.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1524.
Ships and Boats, including their fittings, 1496, 1508.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 1501, 1502, 1526.
Food and Beverages, including apparatus for preparing food for men and animals, 1500, 1513, 1516, 1521.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1495, 1505, 1507, 1515, 1518, 1520, 1522.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1504.
Lighting, Heating, and Ventilating, 1497.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1506, 1517, 1519.
Metals, including apparatus for their manufacture, *None.*
Chemistry and Photography, 1510.
Electrical Apparatus, 1503, 1512.
Warfare, 1494, 1498.
Letter-Press Printing, &c., *None.*
Miscellaneous, 1499, 1509, 1511, 1514, 1523, 1525.

1494. C. Cheyne. *An improved method of constructing safety rifle and other gun ranges.* Dated June 11, 1861.

The object of this invention is to enable men to fire at a target, or targets, or butt, at all ranges, varying from the shortest, say 100 yards, more or less, to the longest, and at all intermediate ranges simultaneously, and with perfect protection and security from the balls discharged from any range or ranges farther from the target than that at which the shooter may be placed. The invention consists in constructing three-sided frames of ball proof material, within which the shooters are to be placed, and in erecting between the butt and the first of the frames, and on the side of the frame out of the line of fire from the frames further removed from the butt, a ball-proof screen which in no way interferes with the line of fire, but which would intercept any ball which might be fired accidentally, or otherwise, from the position assigned to the shooter within the frame. Then between the first and second frames, and between all the succeeding frames the inventor erects similar ball-proof screens. As well as affording protection to the shooters and persons within the screen, the invention allows of parties travelling outside of the line of fire from frame to frame in perfect security. The invention also consists in erecting ball-proof screens in front of the shooter which prevent ricochet shots, and defilade the top of the butt. *Patent abandoned.*

1495. R. W. Smith and D. Statterqood. *Improvements in machinery for manufacturing looped fabrics.* Dated June 11, 1861.

This invention consists in forming the loops of looped fabrics by means of instruments of a new shape and arrangemnt, such instruments being brought into position for producing the right length of loop by means of a regulating bar, slur-cocks, and of the spring of the instruments themselves, or of a spring attached to such instruments. These instruments may also be acted upon by catches, which on being set at liberty by a slur-cock, leave the instruments to act as before stated. These instruments are used as a substitute for the jack and sinkers, used in ordinary frames, and form a jack and sinker in one piece, or if the sinker is desired to be separate from the jack, then the horizontal part of the instrument working the sinker may form the spring for bringing the sinker back into its place. And further, the invention consists in an arrangement of the bar carrying the instruments above referred to, whereby they may be caused to move half a gauge during the working of the frame, thus reducing the cost and simplifying the use of fine gauges. *Patent completed.*

1496. S. B. Singer. *An improvement in the card of compasses.* Dated June 11, 1861.

This invention consists in forming or colouring the surface of one-half of the card of a black, or dark colour, or shade, and in forming or making the surface of the remaining half of a white or light colour, for the purpose of enabling the compass to be told in dark and foggy weather, without artificial light, as well as by day. *Patent completed.*

1497. C. Chalmers. *Improvements in gas stoves.* Dated June 11, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

1498. W. E. Newton. *Improvements in gun-stocks.* (A communication.) Dated June 11, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1499. W. H. Walker. *A floating hydraulic lift stage, for raising navigable vessels or other heavy bodies above the surface of the water and an improved method of "blocking" or "shoreing up."* Dated June 12, 1861.

This consists in a peculiar construction of double floating stages, the two parts being placed parallel to, and sufficiently apart from, each other to admit the vessel to be lifted to be floated in between them. This double stage is connected together by transverse beams or kelson girders, which are capable of being lowered down to admit of the vessel or other body to float over them, when they are lifted up with the vessel to be docked resting thereon. *Patent completed.*

1500. J. A. Dauncey. *Improvements in apparatus for supplying liquid nourishment to infants and invalids, and in the application of such improvements to the feeding of other animals.* Dated June 12, 1861.

This invention relates, first, to a certain description of apparatus used for supplying liquid nourishment to invalids and infants, and which is now well known, wherein an elastic tube is employed externally, and a rigid internal tube to convey the liquid from the vessel to the consumer. The improvement consists in the employment of a jointed tube for the external tube, in contradistinction to the continuous elastic one now used, so that it may be disunited for the purpose of cleaning; and also in the use of an elastic tube having its lower extremity weighted, instead of a rigid one internally, so that the opening end of the said tube may always be submerged in the liquid in whatever position the vessel may be placed, the two tubes being secured to the stopper of the vessel as usual, in which small tubes or orifices are arranged for the admission of air. If required, a number of tubes may be fitted to one vessel, so as to supply many consumers from one vessel. Secondly, the invention relates to the feeding of other animals, such as lambs and calves, and consists in arranging a flexible vessel above the receptacle of the feeding liquid, such flexible vessel being composed of caoutchouc or other suitable material, and either suspended by springs in a framing, or secured by means of a flexible washer on to the lower vessel to give elasticity, instead of having it rigid as hitherto used. The teats for sucking are placed in the sides of the upper or flexible vessel, and communicate with the liquid by tubes jointed for the purpose of cleaning. *Patent completed.*

1501. J Hope and W. Greenhalgh. *Certain improvements in machinery or apparatus for cutting turnips, roots, or other substances.* Dated June 12, 1861.

The substance to be cut is, according to this invention, pressed or forced, by means of a piston, from a hopper against a series of knives or plates, arranged so as to cut or form the substance into lengths of a four-sided or other shape or form, and which are afterwards cut transversely by means of rotating blades or cutters, or descending knives, and the turnip or other substance is delivered in pieces somewhat cubical in shape, and of such dimensions as the knives and rotating blades may be adapted to form them. The apparatus is worked by an ordinary description of mechanism arranged and designed for the purpose. *Patent abandoned.*

1502. W. E. Gedge. *An improved reaping and mowing machine.* Dated June 12, 1861. (A communication.)

This invention is not described apart from the drawing. *Patent completed.*

1503. J. A. Callaud. *Improvements in the construction of electrical piles.* Dated June 12, 1861.

The principle by which the patentee is enabled to dispense with the porous vase employed in Daniel's pile and others, of which it has always proved the most embarrassing piece, is the following:—If a vase be about half filled with a solution of sulphate of copper, saturated cold, and then pure water, or water slightly charged with sulphate of zinc or marine salt, be slowly and with much precaution poured thereon, the new liquid being less dense will remain on the top of the first, and from that moment there will be disengagement of electricity from the contact of these two different liquids or solutions. If electrodes be placed in each, this electricity may be employed. The positive electrode may be formed of a small plate furnished with a conductor intended to carry the positive electricity outside the pile, and this plate may be placed at the bottom of the vase; the conductor, being coated with an isolating substance, will pass through the upper liquid; it may be without such coating, but in such case there will be a slight loss of electricity. Without, or on the outside, a conductor not coated may be used, by passing it through the centre of an isolating cup or funnel. But these means demand the most cautious and careful manipulation, which the new arrangements used permit of being dispensed with, while facilitating the attainment of a constant current. *Patent completed.*

1504. J. Durrant and N. A. Harris. *Improvements in the form and construction of chimney tops, or apparatus for surmounting chimneys, in order to regulate the up-currents and prevent the down-draughts.* Dated June 12, 1861.

This invention consists of a cylinder of metal, preferably zinc or earthenware, or other suitable material; on the top of this the patentees fix, or attach, or form, a series of corrugated cells, opening towards the bottom, so as to receive the external air, which passes out of the top into the interior of an open conical cap fixed there. These cells may be either slightly inclined or vertical; the band on which these cells are affixed, as before stated, opens into a conical cap, which is affixed to, and opens into, and encircles the cylinder. Round the outer periphery or surface is another series of conically-shaped cells, the bottom of which, being open, receives the outer air, and passes it into the interior of another conical cap placed directly over it and concentric with the cylinder. *Patent completed.*

1505. H. Mason. *Improvements in machinery or apparatus for preparing and spinning cotton or other fibrous materials.* Dated June 12, 1861.

This invention relates, firstly, to an improved stop motion for the drawing frame. The trumpet through which the sliver passes from the drawing rollers to the cam or coiler is placed upon pivots and nicely balanced, so that when the sliver is absent from roller lap, breakage, or other causes, or when a snail or lump is formed, the trumpet falls back and acts upon a catch or lever in communication with the stop motion, and stops the frame. Secondly, to improvements in rollers with loose bosses working upon fixed spindles, instead of allowing them lateral motion, as hitherto adopted, which has the injurious effect of cutting or wearing into the sides of the bearings. The patentee makes a collar or swell on that part of the spindle next to the cap. The loose boss is countersunk at each end, or has an internal shoulder, the effect being that, if the roller should be set out of line, the bosses will not work outwards towards the cap. *Patent completed.*

1506. L. J. J. Petre. *A smoke-consuming grate.* Dated June 12, 1861.

This invention relates to a new arrangement of furnace grate for the consumption of smoke, composed of fire bars, each having two parallel side cheeks or flanges, connected at the upper part at intervals by the pieces cast on the cheeks. The upper surface of the fire-bar may be of a round, square, elliptical, triangular, or other form; it is also provided at intervals with elongated holes, arranged in various ways, to allow air introduced at the under part of the grate to pass between the cheeks, and through the tubes in the bars into the centre of the fuel, so as to obtain more perfect combustion. *Patent abandoned.*

1507. J. Watt. *An improved mode of converting vegetable fibrous substances into pulp.* Dated June 12, 1861.

This invention relates to a peculiar mode or process for converting vegetable fibrous substances into pulp, and consists in subjecting the vegetable fibrous substance to the action of proto-carbonate of soda, or bicarbonate of soda, or proto-carbonate of potassa, or of potassa, bicarbonate of soda, or soda ash, in solution in water, by heating the whole to the boiling point, and boiling the same until the fibrous substance has been so acted upon that, on being washed and treated with an aqueous solution of chloride of lime or chloride of soda, it is converted into pulp. *Patent completed.*

1508. J. Drew. *Improvements in the adaption of plates or shields to fixed and floating batteries, and also ships, for the purpose of more effectually resisting shot or other projectiles.* Dated June 12, 1861.

This invention consists in adapting elastic material or springs of metal, in combination with plates of metal or shields, applied to the sides of ships, gun boats, or floating batteries; also to fixed batteries, fortifications, and other places of defence. *Patent abandoned.*

1509. G. Cox. *An improved "floor-dog," or cramp.* Dated June 12, 1861.

The object of this invention is to obtain sufficient pressure against the edges of floor boards to keep them in position, and close together during the operation of nailing to the joists. The inventor proposes using a lever of cast or wrought metal, about the thickness (or rather more) of the floor board; on the under side of this lever are placed two lugs or pegs, rather further apart than the width of the joist, so that, when the lever is brought back from the right angle to the joist, the lugs or pegs firmly grip each side of the joist, while a wooden bar, which is jointed to the lever, presses a driver (also of wood) against the edges of the floor board. This driver is to be driven by blows from a hammer or mallet in a parallel line with the floor boards, which tends to bring the driver from the oblique line to the rectangular, thus forcing the floor boards together during the operation of nailing to the joists. *Patent abandoned.*

1510. J. Napier. *Improvements in stereotyping.* Dated June 12, 1861.

This invention relates to an improved mode of obtaining stereotype plates, which possesses many advantages over the plaster or paper processes. Under one modification, a planed cast-iron plate is prepared to receive the plaster or stucco impression in the following manner:—A piece of cartridge or other paper is cut to the size of the plate, and pasted on the planed surface of the plate. The upper surface of the paper is also pasted, and a mixture of plaster of Paris and water, prepared to the consistence of thick cream, is poured on to the paper. The surface of the plaster is levelled to the required thickness by means of a straight edge or other suitable tool. The form containing the type blocks or pages to be stereotyped is locked up by quoins in the usual manner, to prevent the type from falling out, and the surface of the type is oiled. The form is inverted, and the type laid with its face downwards upon the freshly-prepared plaster, and the form is allowed to remain until the plaster has set. The form is lifted off, and the plaster dried completely from the metal side. This may be conveniently done by means of an ordinary type founder's furnace, arranged with a fire-clay or brick flue, fitted with an iron plate, to facilitate the drying of the matrix. A flat cast-iron plate covered with paper is provided, and this plate has metal gauges to regulate the thickness of the stereotype plate. The matrix plate is screwed or wedged to this plate, and both are well heated; the molten metal is then poured in; and an exact counterpart of the type or form is obtained. After allowing the stone cast to cool, it is removed and finished by planing or chipping, if necessary. *Patent completed.*

1511. D. Walmsley and J. Rostron. *Improvements (partly for the purpose of preventing accidents) applicable to hoisting machines, used in mills, warehouses, and other places.* Dated June 12, 1861.

The first part of this invention relates to a system or mode of stopping the motion of hoisting machinery by self-acting arrangements at any predetermined position or floor; so that, if the hoist-box is at, say, the bottom, and the attendant wishes it to ascend to any one of the floors above, he has only to arrange a simple stop or handle, and he may leave the hoist after putting the driving gear into motion, and it will stop at the required floor. The second part of the invention relates to a method of closing the doors leading to the hoist shafts, so as to prevent accidents, which frequently happen by persons falling down the hoist-shaft. The patentees limit this part of their invention to closing the doors, and not to both closing and opening. The means by which they carry this part of their invention into effect consists in arranging the doors to slide vertically, and so as to open by descending and close by ascending, and in balancing the doors in somewhat similar fashion to that in which the ordinary window sash is hung, making the weight preponderate, so that the door will always ascend or close when left alone. *Patent completed.*

1512. R. Jobson and C. F. Farley. *Improvements in posts or supports for telegraph wires.* Dated June 12, 1861.

For the purposes of this invention, the patentees employ tubes of cast-iron, made either conical or parallel, and in lengths, or sections, which it is preferred should be capable of fitting one inside the other for facility of carriage. These lengths or sections fit together with suitable joints. *Patent completed.*

1513. J. P. Girard. *An improved coffee-mill.* Dated June 12, 1861.

This mill is fixed on a box furnished with a drawer for receiving the coffee when ground, and having an upright board, which forms the back of the apparatus. The coffee is first placed in a funnel-shaped receptacle of sheet iron, or other suitable material, and, on turning a handle, a toothed grinder of cast iron is made to gear with the teeth of a core also of iron. The grinder is fixed to the upright board above-mentioned, by two bolts or pins furnished with nut screws. The mill is regulated by means of a thumb screw, and the teeth of the girder and those of the core are so arranged as never to rub against each other, whereby the mechanism is preserved from all injury. *Patent abandoned.*

1514. C. Swan. *An improved form of travelling bags.* Dated June 13, 1861.

This invention consists in the peculiar way in which the patentee forms the bag or portmanteau, by means of which he is enabled to obtain large capacity in the article, with great convenience, and comparatively small cost and amount of material. The first part of the invention consists of a frame formed of two rectangular segments jointed at each end in the centre, so as to open and shut by folding on each other. The next part of the invention relates to the form of pieces composing the bag. The end pieces or gussets are made so as to be nearly rectangular in form, and slightly rounded at the upper end. The sides are similarly formed, being nearly rectangular both at top and bottom; the bottom of the bag is of the usual form, and may either have a joint through the middle or not; the whole is attached to the frame in the usual manner, and the result of the combination is such as to give a bag or portmanteau a much larger capacity than can be obtained by those as now formed. *Patent completed.*

1515. W. E. Gedge. *Improved beating apparatus for picking and cleaning substances used in making or manufacturing woven or textile fabrics, more especially cashmere, alpacas, and other fine materials, and preparing the same for scouring.* (A communication.) Dated June 13, 1861.

This apparatus is mounted on a cast iron framing (it may be of wood), and is composed of two cylinders revolving in the same sense, and furnished with teeth; these teeth cross with shorter teeth with which two fixed cylinders are furnished. The two moveable cylinders, besides their circular motion, are impelled to a come and go movement by means of an excentric. A grating is so placed as to allow impurities, from the wools (or other material) to fall through it into a receiver. An endless cloth, motived by a pulley, introduces the substances to the cylinders. This apparatus is used in double, so that the operation may be repeated, to ensure complete purification. *Patent abandoned.*

1516. E. Chatonet. *A machine to perfection easily-opened covers for tin boxes, or cases for packing sardines or other provisions.* Dated June 13, 1861.

This machine (solidly supported on a block of wood) is composed of two cast-iron puppets, united by a sockle of considerable strength, to ensure the rigidity of the apparatus. A shaft passes from one puppet to another, revolving in bronze bearings, and carrying at one end a pinion, maintained in position by a screw, and at the other a mill or roller in cast steel, representing in relief the moulding intended for the covering for boxes. Immediately below the shaft first mentioned a second shaft traverses the two puppets, and this also revolves in bronze bearings. The upper bearings are movable, and this is obtained by press screws, allowing space for a conical gearing wheel at one end, the other being furnished with a mill or roller in cast steel. This disposition of the mills (for milling or rolling the tin) allows them to approach and retire at the will of the operator. *Patent abandoned.*

1517. H. Holland. *An improvement in the manufacture of umbrellas and parasols.* Dated June 13, 1861.

This invention consists of securing the ivory finish or ornament which is affixed to the end of the tubular ribs of umbrellas, and parasols, by passing through the said ornament a metal pin, headed somewhat like an escutcheon pin, which pin, after having been passed through the ornament to the extent of about a quarter of an inch, is inserted and fastened to the end of the rib, by compression of the said rib. That part of the pin on which the end of the rib is closed is of somewhat less diameter than the other part, so that, when the end of the tube is closed thereon, the pin cannot be drawn out of the rib. *Patent abandoned.*

1518. J. Knowles. *Certain improvements in machinery for preparing cotton and other fibrous materials.* Dated June 13, 1861.

This invention is applicable to the lap machines of blowers, scotchers, derby doublers, and other machines in which a lap of fibrous materials is formed under pressure. It has heretofore been customary to lap the piece of fibrous material on a roller, the axle of which is weighted and turned round by the friction of two rollers, between which the lap is formed. Now this invention consists in applying one or more additional rollers above the lap, which roller or rollers is, or are weighted. The top roller or rollers may be driven by gearing, or not driven, according to the peculiar construction of the machine to which the invention is applied. Another part of the invention consists in an improved mode of applying the side plates or washers to the lap rollers; these washers have trunnions revolving in side bars or levers; the end of each trunnion acts against a handle or tail pin, screwed in the bush of the side lever, and by turning these handles or tail pins, the distance between the side plates or washers is regulated. *Patent completed.*

1519. E. Bing. *Improvements in the construction and fittings of sliding window sashes.* Dated June 13, 1861.

This invention consists in a method of fitting and furnishing sliding window sashes whereby they may be readily removed from their position for the purpose of cleaning, and which may thereby be effected entirely within the building to which they are fitted. *Patent completed.*

1520. J. Illingworth. *Improvements in arranging sizing-houses, brew-houses, dye-houses, and other houses, and chambers, to facilitate the removal of steam set free therein, also in the construction of troughs for sizing cotton warps, and in boxes or other receivers for holding such sized cotton warps.* Dated June 13, 1861.

The object of part of these improvements is to cause the steam employed in various processes to pass freely away from the apartment or chamber in which it is employed. For this purpose the patentee forms all parts of the roof and flooring where the steam is produced or set free, as air-tight as possible, and also by its thickness or otherwise, so as to avoid the conduction of cold within. He admits all the air required from the lower part of the room. He applies pipes, chimneys, or other ventilators rising above the roof to a considerable height, say from two to forty feet, formed to prevent the admission of rain, and yet allow the free escape of the steam, and so that any investure formed by condensation on the ventilators may be readily conducted away. Iron, lime, and bricks, or stones, or other suitable materials, covered with three coats of gas-tar, or other material adapted to prevent the admission of air or cold, are well adapted to form such chambers, roofs, pipes, chimneys, or ventilators. The sizing troughs when made of wood are to be bolted together, so that the bolts can be seen on the parts they hold together, with guides of suitable materials secured without bolts and screws inside, or going into or through the trough sides, and so that the guides will leave or may be removed from their places without breaking the warp. Also rollers of suitable materials to run with shaft and pedestals made of charcoal, iron, or other cast-iron are used. The boxes or other receivers for the wet warps, are made of wire-work, or are otherwise reticulated, and adapted to admit the free passage air thereto and therethrough. *Patent completed.*

1521. F. Gregory. *Improvements in machinery or apparatus for cutting hay and chaff, or other similar purposes.* Dated June 13, 1861.

This invention consists, firstly, in fixing upon the driving shaft, or the shaft to which the knives or cutters are attached, a pur' wheel, with one or more teeth, pur's, or pegs working in a tangent, star, or intermittent wheel, for the purpose of giving an intermittent feeding motion to the hay, chaff, or other matter to be cut; the edge of the intermittent wheel is formed with concavities corresponding with the circular part of the pur' wheel, for the purpose of preventing the turning of the intermittent wheel until the tooth or teeth, peg or pegs, on the said pur' wheel enter the slots or openings of the said intermittent wheel. Secondly, in employing a varticle shaft for driving the upper feed roller. The said shaft works in an antifriction box, in order to enable the roller to rise and fall with ease according to the thickness of the feed. To the shaft is fixed a stud on each side at right angles to its length, which studs are mounted with antifriction bowls, working in grooves in the box, which is driven by toothed wheels from the bottom roller. *Patent completed.*

1522. S. Cook and W. H. Hacking. *Improvements in machinery or apparatus for plaiting or folding woven fabrics.* Dated June 13, 1861.

This invention consists in applying to the o
ing machines a relieving motion, in or
machine to fold finished fabrics witho

side of the table is attached by a strap or chain to a quadrant or segment, and then connected to a lever fixed to the ordinary working shaft in the centre of the machine, to which shaft a working motion is imparted by a rod connected with a revolving crank in the usual manner. When the aforesaid parts are put in motion, each end of the table is depressed alternately, and allows the fabric to pass underneath the card rails without contact or friction, and thereby preserves the fabric from fraying or damage, thus enabling fabrics of the finest materials or colors to be folded. *Patent completed.*

1523. HON. C. DUNCOMBE. *Improvements in machinery for sawing wood and other substances.* Dated June 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1524. B. BLACKBURN. *Improvements in applying oil or lubricating fluid to locomotive and other axletrees.* Dated June 13, 1861.

In this invention the vibration or jolting of a railway carriage in motion is made use of to splash the oil contained in a closed vessel introduced into or forming a compartment of the axle box, up to an aperture in the upper part of the vessel or compartment, through which the oil flows out of the vessel, and runs down to the journal beneath. A vibrating spring paddle is sometimes applied near to the bottom of deep vessels, to assist in splashing the oil up from the bottom to the aperture in the upper part of the vessel. *Patent completed.*

1525. T. M. DOWNING. *Certain improvements in the manufacture of corks and bungs.* Dated June 13, 1861.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

1526. W. BAYLISS. *Certain improvements in chain-harrows for harrowing land.* Dated June 13, 1861.

These improvements in chain-harrows consist in keeping the combined links forming the chains fully extended, and which the patentee purposes effecting by the use of a suitable number of thin strips of steel, iron, or other suitable material, sufficiently elastic or pliable that, as the harrow is drawn over or obliquely across ploughed land, it shall readily adapt itself to the inequality or unevenness of the surface over which they pass. *Patent completed.*

1527. W. C. THOMAS. *Improvements in metal casing or armour for the defence of ships and batteries.* Dated June 14, 1861.

This consists in the use of laminated plates for the defence of ships and batteries, which is effected either by simple lamination, that is to say, laminated plates of a single metal such as iron, steel, copper, or lead; or by compound lamination, in which iron, steel, or copper plates will be alternated with leaden layers or strata, or with some flexible material, such as leather. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 16, 1861.

2043. J. Livesey, New Lenton, Nottingham, lace manufacturer. A new textile fabric for embroidery trimmings and other ornamental purposes, and machinery employed in making the fabric into trimmings.

Dated Oct. 29, 1861.

2705. E. Sackow and E. Habel, Manchester, engineers. Improvements in antifriction mechanism for receiving the end thrust of screw propeller and other rotating shafts.

Dated Nov. 22, 1861.

2939. W. Evans, Commercial-road East, master mariner. Improvements in obtaining motive power by machinery.

Dated Nov. 25, 1861.

2951. V. Pendred, Jun., Bally Curron, Kilkenny, engineer. Improvements in the construction and materials of surface condensers.

Dated Nov. 26, 1861.

2967. J. Brown, 2 Ribchester-terrace, Bridge-road, Stratford, machinist. Improvements in fire bars and furnaces.

Dated Nov. 30, 1861.

3018. J. W. Gibson, Hammersmith Iron Works, Dublin. Improvements in ordnance, applicable also to small arms.

Dated Dec. 3, 1861.

3025. T. W. G. Treeby, 1 Westbourne-terrace Villas, Paddington. Improvements in machines for boring holes in rocks and other hard substances.

3026. R. A. Rust, 34 Great Marlborough-street, Westminster, pianoforte manufacturer. Improvements in the construction of the cases of pianofortes.

3029. J. Burrows, Wigan, and J. Dougan, Haigh, Lancaster, engineers. Certain improvements in winding or driving drums or pulleys.

3031. G. T. Bousfield, Loughborough-park, Brixton. An improved stopper for bottles, decanters, jars, and similar articles. (A communication.)

3033. W. Duchemin, Charlotte Town, Prince Edward's Island. Improvements in blocks for hoisting.

Dated Dec. 4, 1861.

3035. W. E. Gedge, 11 Wellington-street, Strand. Improvements in the manufacture of nose bags and similar articles, and in apparatus connected with such manufacture. (A communication.)

3037. T. Stead, cotton spinner, and W. Higham, overlooker, Ashton-under-Lyne. Improvements in machinery or apparatus for spinning cotton or other fibrous materials.

3039. J. E. Boyd, Hither-green, Lewisham, gentleman. Improvements in scythes, scythe handles, and apparatus for connecting the same.

3041. W. E. Newton, 66 Chancery-lane, C.E. Improvements in pumps. (A communication.)

3043. W. H. Balmain, Saint Helen's, Lancaster, manufacturing chemist. Improvements in the manufacture of potash and salts of potash.

3045. A. Pullan, New-cross, engineer, and W. Lake, mechanical draughtsman. Improvements in traction and other engines, and in wheels for traction engines and other carriages, and in giving motion to ploughs and other agricultural machines.

Dated Dec. 5, 1861.

3049. G. W. Robertson, Cannon-street, engineer and millwright. Improvements in machinery for cleaning rice and other grain.

3051. W. Dicks, Floore, Northampton, smith. Improvements in pumps.

3053. W. Bushby, Newton-le-Willows, near Bedale, York, agricultural implement manufacturer. Improvements in ploughs.

Dated Dec. 6, 1861.

3057. A. W., R., and W. Woodward, Manchester, engineers. Improved arrangements of compound steam engines.

3059. C. Cruddock, 5A, Orchard-terrace, Kensington, dressmaker. An improved system or method of cutting out ladies' dresses.

3061. E. Collier, Aldershott, boot and shoe maker. Improvements in coverings for the feet and legs.

3063. W. Smith, Kettering, Northampton, agricultural implement manufacturer. Improvements in the construction of horse hoes.

3065. H. G. Schramm, 149 Bolhenburgsort, Hamburgh. Improvements in rotatory engines and pumps. (Partly a communication.)

Dated Dec. 7, 1861.

3069. R. Jolley, 47 St. John-street, Smithfield. An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids, alimentary or otherwise.

3071. D. May, Wood-street, warehouseman. An improved method of securing scarfs and similar articles to the neck.

3073. H. W. Bristow, Geological Museum, Jermyn-street, gentleman. Improvements in the manufacture or production of candles. (A communication.)

3075. T. Mellodew, Oldham, manufacturer, C. W. Kesselmeyer, Manchester, warehouseman, and J. M. Worrall, Salford, dyer. Improvements in dyeing and printing certain descriptions of woven fabrics.

Dated Dec. 9, 1861.

3081. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in the production of relief designs on metallic surfaces for general printing, gaufering, and embossing purposes. (A communication.)

3083. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatuses to be employed therewith. (A communication.)

3085. S. W. Silver, Bishopsgate-street, manufacturer, and H. Pringle, King's-road, Chelsea, gentleman. Improvements in shoes for horses and other quadrupeds.

3087. W. Clark, 53 Chancery-lane, engineer. Improvements in gloves. (A communication.)

Dated Dec. 10, 1861.

3089. C. Tear, Liverpool. Improvements for facilitating the drying of wet or damaged cotton, or wool, or other similar fibrous material.

3091. H. Spencer, Rochdale, agent. Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances.

3093. J. A. J. Redier, 2 Rue Sainte-Appoline, Paris. Improvements in pocket watches.

3094. V. L. Dagzan, 2 Rue Sainte-Appoline, Paris, France, painter. Improvements in the method of paving roads and other places.

3095. G. C. Lock, Liverpool. Improvements in cinder sifters.

3097. W. E. Newton, 66 Chancery-lane, C.E. Improvements in breech-loading cannon. (A communication.)

3099. D. Vogl, Sambrook-court, Basinghall-street. Improvements in garments for gentlemen and ladies' wear.

Dated Dec. 11, 1861.

3226. R. A. Brooman, 166 Fleet-street, patent agent. A new or improved method of treating teasles or thistles to be used in the teazling of cloths and stuffs and otherwise. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

3190. O. C. Evans, Whitton, Twickenham. Improvement in sewing machines. Dated Dec. 20, 1861.

3197. J. Redfern, Hanley, Stafford. Improved apparatus for raising the temperature of air, in order to warm churches, conservatories, houses, and other buildings or places. Dated Dec. 20, 1861.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2035. J. T. Hutchings. Tennis and racket bats.
2043. J. Livesey. Textile fabrics.
2057. E. S. Cathels. Gas-meters.
2058. W. H. Smith. Manufacture of peat.
2061. T. Pedrick. Motive power.
2066. H. Emes. Dress fastenings.
2071. J. Somerville. Drilling and tapping.
2374. R. S. Lambert. Removing liquids from boiling pans.
2079. J. Ellis. Corks.
2096. J. H. Johnson. Preparation of pulp for paper. (A communication.)
2103. T. Richardson and R. Irvine. Manufacture of paper.
2107. A. B. Childs. Millstones. (A communication.)
2114. M. Hyams. Smoking pipes and cigar tubes.
2115. J. Driver and J. Jessop. Washing, wringing, and mangling fabrics.
2117. J. Cranston. Conservatories.
2136. J. B. Fonda. Steam and other boilers.
2141. J. Ronald. Dressing fibrous material.
2146. J. Duncan. Manufacture of sugar.
2148. S. Corbett. Crushing and grinding.
2152. P. Jewell. Concertinas.
2156. R. Shaw. Hoisting and lowering weights.
2166. J. Bishop. Pile fabrics.
2171. P. Taylor. Preventing incrustation in steam boilers.
2185. W. Clark. Prevention of railway train collisions. (A communication.)
2197. G. Bischof. Extracting copper and silver from ores. (Partly a communication.)
2220. T. Greenwood. Sawing wood.
2253. R. A. Brooman. Woollen and other threads. (A communication.)
2676. J. B. Schalkenbach. Musical instrument.
2738. W. J. Williams. Scales.
2900. G. Parry. Iron and steel.
2963. G. Clarke. Fire escape.
3031. G. T. Bousfield. Stopper for bottles. (A communication.)
3036. J. Hemingway. Textile fabrics.
3066. J. J. Russell and B. L. Brown. Taper tubes.
3102. H. Tanner and W. Proctor. Applying manure to growing crops.
3190. O. C. Evans. Sewing machines.
3197. J. Redfern. Warming churches.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Dec. 26, 1861.

1653. J. W. Graham and J. Wright.
1656. S. Middleton.
1661. J. Dyer.
1667. I. Bragg.
1669. W. Livesey.
1672. F. Potts and R. Cox.
1674. L. H. Spence.
1677. J. P. E. Paignon, J. M. Vaudaux, & G. Gagnière.
1693. J. F. Spencer.
1708. J. Hutson.
1718. T. Wilson.
1735. A. Priest and W. Woolnough.
1756. T. J. Smith.
1805. A. Elliott.
1822. M. Henry.
1833. J. and J. Cole.
1905. A. Wood.
2251. J. H. Johnson.
2367. W. Tongue.
2540. C. N. Kernot and M. D. Rucker.
2571. J. Dixon and R. Clayton.
2707. F. Bennett.
2766. J. Archer.

Dated Dec. 31, 1861.

1679. J. G. Wilson.
1690. G. Davies.
1694. J. Petrie.
1695. P. Spence.
1700. J. M. Gale and T. Kennedy.
1709. O. Williams.
1712. R. Lakin & J. Wain.
1715. J. Dean.
1725. C. Farrow.
1741. C. Cochrane.
1743. J. German and G. N. Browne.
1744. T. T. Chellingworth and J. Thurlow.
1752. T. Reeves.
1792. C. D. Abel.
1840. W. E. Newton.
1874. F. Johnson and B. Hockin.
1904. H. J. Holland and W. Payton.
2254. W. E. Newton.
2774. E. Brooks.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

25. R. Tempest and J. Tomlinson.
2953. M. A. F. Mennons.
2992. R. A. Brooman.

PRICES CURRENT OF METALS.

London, Dec. 26, 1861.

		£	s.	d.		£	s.	d.	p.ct
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	0	0	0	nett
Welsh Bars, in Wales	„	5	6	0	„	5	7	0	3
Staf. Bars, at the Works	„	5	10	0	„	7	5	0	2½
„ Hoops	„	7	10	0	„	0	0	0	„
„ Sheets, Singles	„	0	0	0	„	8	0	0	„
„ Nail Rods	„	5	15	0	„	0	10	0	„
„ Boiler Plates	„	0	0	0	„	8	10	0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow		2	10	0	„	2	11	0	nett
Do. No. 1, Good Brands	„	2	13	0	„	2	10	0	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	98	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	103	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9½	„	0	0	0	„
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	16	0	0	„	0	0	0	„
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	0	1	0	„	0	0	0	nett
„ Straits	„	5	17	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I.C.	„	1	1	0	„	1	4	0	„
LEAD:									
Pig, English	pr. ton	19	10	0	„	20	0	0	3½
„ Spanish	„	19	0	0	„	19	10	0	„
Common Sheet	„	21	10	0		22	0	0	„
Tea „ (Wimshurst's Patent) A special disct.	„	35	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	17	12	0	„	17	15	0	nett
For arrival	„	17	16	0	„	0	0	0	„
ZINC:									
English Sheet	„	26	0	0	„	0	0	0	1
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	3

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 10, 1862.

THE FOULING OF IRON SHIPS.

We believe it is now almost universally admitted by those competent to form an opinion on the subject, that iron is the best material that can be used for the building of ships. Its advantages over wood are numerous and important, and the latter material, except for the internal fittings of vessels, will in time, probably, be banished from shipbuilders' yards. One important objection to iron, however, still exists, and that is, its propensity for fouling. Many experiments have been tried with a view to the obviation of this serious drawback, but, hitherto, it must be admitted, without very satisfactory results. We have little faith in chemical compositions for the coating of ships' bottoms as a panacea for the evil, and believe that the remedy must be sought for in the direction of a different mechanical arrangement in the construction of iron hulls. Some months since, when writing on this question, we suggested that the British Government would do well to stimulate the inventive genius of the country by the offer of some material reward for the solution of the problem- how to prevent the fouling of iron ships. We are still of opinion that some such course should be adopted, if not by the Government, then by the shipowners of England generally. It is a reflection upon the scientific skill of Englishmen that, although it has shown the world how to build iron ships in almost all respects superior to those of wood, it cannot propound an efficient check to that process of deterioration which commences almost as soon as those ships touch salt water. Surely it would be wise, on this national ground alone, to offer some inducement more than at present exists for the discovery of an effectual means of preserving our noble war fleet and our merchant ships from the pernicious effects of fouling.

To shipowners who may think that they have nothing to do with the maintenance of the scientific supremacy of their country, we would say that in a merely commercial sense they are deeply interested in the subject under discussion. The delay, and consequent increase of expenditure, which attends the homeward voyages especially, of iron vessels, they cannot be strangers to, or indifferent about. Would it not, then, be wiser for them to unite together, and by offers of liberal remuneration to the propounders of a successful method for the prevention of fouling, endeavour thus to call them forth? That a remedy for the evil will eventually be found, we entertain no manner of doubt. It is not in the nature of Englishmen to allow themselves to be beaten by practical difficulties, and it requires no great stretch of the art of divination to foretell that the one in question will, bye and bye, cease to exist. Whilst, however, we are awaiting the arrival of this "consummation so devoutly wished," the mischief goes on, the nation knows that it cannot stay it, and the scientific community suffers the humiliation of being considered completely at fault on a point of science which really seems almost elementary.

In speaking thus, we are by no means unmindful of what has been attempted in the way of preventing the evil spoken of. One gentleman, in particular, it would be an act of injustice to omit reference to while considering the question, and that gentleman is Mr. Grantham. With steady determination, he has devoted himself, for some years past, to the attainment of the object, and has laid his plans for its accomplishment before the Board of Admiralty. Mr. Grantham has met as yet, we believe, with but small encouragement in the laudable course he has been pursuing. His propositions, nevertheless, carry with them a considerable amount of plausibility, and certainly they are deserving of careful attention. In May, last year, when discussing a paper read by Captain Halsted at the United Service Institution, Mr. Grantham explained his views in reference to the fouling of iron ships and its remedy so clearly that we have no hesitation in reproducing his remarks. He said, "there is no plan yet invented for keeping iron ships clean, nothing at all approximating to a remedy, except that of coppering them."

This Mr. Grantham thought to be the best, if not the only way of overcoming the evil, and his mode of coppering an iron ship was thus described by himself :—"I start by riveting to the outside, iron ribs rolled of the proper form. These are made for the purpose of retaining a system of wooden wedge-work-blocks of wood, say four inches in thickness; they would be formed by machinery to a mould, and therefore would not be at all expensive. The timber used may be pine, and when made, they would require to fit tightly, and be driven into their places. The inner frame might be reduced in thickness to compensate for the additional strength given by the ribs, &c., so that the vessel need not be increased in weight, or in cost. To this inner frame of wood a plank sheathing should be secured by brass screw-bolts, the whole being well coated as the wood is applied. . . . . Having done this, and the whole being re-coated, and every pains taken to make it perfectly solid, and free from contact with the iron, the vessel should be coppered in the usual way."

Mr. Grantham further entered into some explanations in regard to minor difficulties, which stood in the way of coppering an iron ship, and ended by expressing an earnest aspiration to the end that the Government might be induced to give his plan a fair trial. It is proper to state that the above mode of proceeding referred more particularly to ships of war, and especially to armour-plated vessels, such as the *Warrior*, *Black Prince*, &c. Without giving our complete adhesion to Mr. Grantham's mode of overcoming the evil of fouling, we must repeat that it is one worthy of the highest consideration; and as that gentleman brings to bear on the subject a vast amount of practical knowledge and experience, gained in the building of iron ships, we think that it is the duty of the Government to pause before refusing to test his plans by actual experiment. If the joints of the wooden "wedge-work" could be made thoroughly water-tight, there is reason for thinking that iron ships so encased would be far more durable than at present, and we need not say of how much consequence that consideration alone is. We shall be very glad to find that the Legislature, which will presently assemble for "the despatch of business," and which of necessity will have to deliberate much on naval affairs, may not pass unnoticed, the question of the "Fouling of Iron Ships" It is one in which the whole nation is interested, for the rapid depreciation of our iron ships from fouling, can only be compensated for at present by increased expenditure and heavier taxation.

HOROLOGY.

We take some credit to ourselves for having introduced the above subject to the consideration of the mechanical classes generally, of Great Britain, and are pleased in thinking that our doing so has been in every way advantageous. The gradual declension of the watch and clock trades in this country had become of late years so painfully apparent, that it was impossible to avoid seeing, and feeling it. In America, in Switzerland, and in France, on the contrary, those trades are thriving to an extraordinary extent, and the British market is inundated with time-keepers from those places.

This disastrous state of things we have, as our readers know, commented upon at intervals during the last two years; and we have also, so far as our judgment enabled us, pointed out remedies for it. Those remedies were, the introduction into the watch and clock making arts, of automatic machinery, standard gauges, and other such means, for the rapid manufacture of the various parts of clocks and watches.

We further advised the horologists of England to take counsel together, and by a firm union among themselves, a departure from the old jog-trot and traditional modes of working, and unceasing exertions to produce articles both better and cheaper—or cheaper because better —than those foreign importations which drove their own wares from the market, raise themselves to a higher position. As regarded the manufacture of Church, Institutional, Governmental, and Railway time-keepers, we felt that the period had arrived when it might well be taken up by the engineers of this kingdom. Our advice and opinions have, we have reason to know, not been without their due weight. In Clerkenwell, especially, during the past few months, there has been a perfect revival in the watch and clock trades. Employers have met together, compared notes, and discussed with candour and earnestness the "best practical means for improving the condition of the watch trade." In attempting the solution of this question much diversity of opinion has manifested itself, but the spirit in which it was approached by all was admirable. There is no room to doubt that the first proofs of the renewed energy of English horologists will be found in the coming International Exhibition. The superiority of British horological workmanship will, we have reason to know, there be made palpable. At any rate it is satisfactory to note the determination of the heads of the English watch and clock trades, to do their best in the approaching trial of practical ability, and we heartily trust that triumph awaits them.

We have said that we suggested the idea of engineers becoming the makers of great clocks, and if we are not misinformed, the Messrs. Napier, of York-road, Lambeth, have actually realised that idea. They may now very justly style themselves "engineers and clock makers," for they are constructing a number of clocks for the public institutions of Madrid, and of other cities of Spain. The example of the Messrs. Napier we shall gladly see followed by other engineers, because we believe that large clocks might be better made by them than by any other class of workmen in the kingdom. Truly is there hope for horology in England when so much activity is observable on all sides in connection with it.

JEWELLERS' GOLD.

The above term is frequently used, but is by no means generally understood, and when a person enamoured of some bracelet, chain, or ring, exposed for sale in a shop window, and marked "Fine Gold" buys it, he or she usually purchases something very different to that precious material. Unless initiated completely into the mysteries of jewellers' gold, the purchaser gains little by inquiry into the quality of the material of which the trinket is composed. The answer usually made by the shopkeeper is that it is sixteen, or eighteen, or it may be twenty carat gold. Probably many of our readers would comprehend the degree of fineness which either of these definitions was intended to convey a knowledge of, but there are also many who do not, and for the benefit of these latter, it may be well to enter into some explanation of the terms.

It must be understood, then, that from very ancient times it has been the practice to divide the ounce troy of gold into twenty-four imaginary parts. An ounce of pure gold, therefore, and what is called twenty-four carat gold, are identical terms. Anything less than twenty-four carat gold indicates that in an ounce weight of that substance there are so many twenty-fourth parts of pure gold, and that the remaining portion of an ounce of it is made up of an alloy of some inferior metal—usually copper. Except for wedding rings, which are, or should be, made of standard gold, consisting of twenty-two parts or carats of pure gold, and two of copper alloy, jewellers seldom use gold of a higher rate of purity than eighteen carat. How often they use it of a much lower degree of fineness they know best. There is no doubt that it is possible to give almost any colour to gold, by the addition of particular alloys, and of late, ingenuity has been at work to give the sixteen carat gold the appearance of pure gold. This is done by aid, partly, of what is technically known as the colouring pot, in which the metal is treated to an acid bath of a certain amount of strength. By the judicious use of this contrivance, twenty-two carat gold may be made to resemble very closely native gold, as found in the shape of nuggets in California or Australia. Nuggets are never, however, found to be pure gold, they consist for the most part of 23 or 23½ carat gold, the fraction being made up of an alloy of some inferior metal. In order to test the purity of gold the application of heat is perhaps one of the simplest means. Pure gold will not be in the least discoloured by it, whilst 23 carat gold will take a slightly red tint. There is this disadvantage about the mode of testing suggested, it will certainly discolour very materially all gold of degrees of fineness inferior to that of twenty-three carat, and nothing but the acid bath will restore it to its original hue. In order to effect this latter operation on a small scale, nothing more is necessary than to obtain an earthen pipkin, or gallipot, place the article in it, cover it with nitric acid, and hold it over a spirit or gas lamp, or even a candle, until the acid boils. The result will be that the metal will be restored to its original brightness.

As regards the testing of the genuineness of gold coin, there is nothing equal in simplicity or efficacy to weighing it. It is impossible that any metal inferior to standard gold can be used in the manufacture of counterfeit sovereigns or half-sovereigns which will give pieces, of the same size, of equal weight. It need not be said that the weight of a British sovereign as it leaves the Mint is within a quarter of a grain, over or under, ·256 oz., and that the weight of a newly minted half-sovereign is ·128 oz., with a still smaller latitude over or under.

The testing of "Jewellers' gold," when used in the manufacture of many kinds of trinkets is a matter attended with considerable risk and difficulty, and perhaps the only means readily at the command of the purchaser for ensuring a proper relationship between quality and price, in such cases is to ascertain the respectability of the seller. The constant market price of unmanufactured standard gold—that is, gold of twenty-two carat fineness—is £3 17s. 10½d. per ounce, and with a guarantee from the jeweller that his wares are of a stated and certain degree of fineness below the standard point, a purchaser may form for himself an estimate as to what should be the price of the article he wants—of course, making allowance for the cost of workmanship. "Jewellers' gold" must after all, perhaps, remain a doubtful metal, and we can only hope that the data above given may help intending buyers to judge to some extent of the character of the material.

Literature.

The Builder's and Contractor's Price Book for 1862. Revised by George R. Burnell, Civil Engineer and Architect. London: Lockwood and Co., Stationers' Hall Court, E.C.

The title of this work is almost sufficient in itself to denote its character, if it were not already well known among the classes to whom it is more particularly addressed. This edition, however, appears to have been prepared with especial care, and the number of trades to which its contents have reference is great. The task of editing a work of this kind, intended as it is, to be a reliable guide to employers and employed, in all that pertains to the cost of labour and materials, is an arduous and difficult one. Mr. Burnell, from his great experience in civil engineering and architecture, has been well schooled for such an undertaking, and we believe it will be found by those who refer for information to the pages of the "Builder's and Contractor's Price Book," that he has acquitted himself well. In addition to price-lists of materials and labour in connection with the twenty-eight separate branches of practical industry to which the work refers, many useful tables are given; and, indeed, all that could be supposed to invest it with yet further practical value, has been apparently accomplished.

◆

Hand-book of the Slide Rule, shewing its applicability to, 1.—*Arithmetic (including interest and annuities)*; 2.—*Mensuration, superficial and solid (including land surveying).* By W. H. Bayley, H.M.E.I. Civil Service. 12 mo. Bell and Daldy, Fleet-street.

This little work may certainly be considered a valuable addition to the practical literature of the day. The author has, with consummate care and great perspicuity, endeavoured to explain the innumerable uses to which the slide-rule, in the hands of an engineer, or general mechanic, may be put. His rules are plain, explicit, and familiar, and we venture to say that any intelligent workman, into whose hands they may be placed, will very soon discover for himself hundreds of purposes to which his slide-rule may be applied with advantage, and which purposes he had not dreamt of. In short, there are, according to the showing of the author of the Hand-book, few calculations which may not be more concisely or readily worked out, by the aid of the slide rule, than by any other means. Four points in particular are dwelt upon, and these, though of much importance, have been, heretofore, far too much neglected. They are, 1st, the method of preparing "formulæ," adapted to the instrument; 2nd, the facility of, in many cases, taking out several answers at once; 3rd, the advantage of using the slide inverted; and 4th, the peculiar adaptation of the slide rule to cases where squares and square roots are concerned. The rules are applicable to any and every variety of the handy little instruments in question, but more especially so to the slide-rule of Messrs. Elliott, of the Strand, which has extra-lines, and figures, that extend its use to cubes, and cube roots.

The Hand-book contains many valuable appendices, which go to show the wide and varied range of mechanical and scientific calculations, to which the slide-rule may be advantageously applied, if its characteristics be once completely understood. Tables of French measures and weights, compared with English, as well as the respective value of the British and Foreign coinages tend to make the Hand-book yet more valuable, and to exhibit still more favourably, the industry and forethought of its author. Altogether, we have no hesitation in recommending the work to the attention of all who have occasion to use a slide-rule for any purpose whatsoever. To the majority of working men, their pocket-companion is little more than the "stick of inches," which they familiarly term it, whilst the host of small figures and lines upon it, are as unintelligible to them as would be Egyptian hieroglyphics, or Greek characters. The Hand-book is the sphynx which solves all the riddles of the slide-rule, and makes it what it should be, the Mechanic's friend, and the calculator's assistant.

◆

Adcock's Engineer's Pocket Book for the year 1862. London: Simpkin, Marshall and Co., Stationer's Hall-court.

This old established pocket book abundantly maintains in this year of grace its well earned reputation. It is replete with rules, information, and tables relating to all branches of engineering science, civil and mechanical. To attempt to convey an idea even of its varied contents, in the brief space we could devote to such a purpose, would be to attempt an impossibility. We can only cordially recommend it to the notice of all who are engaged in the carrying out of engineering works of any kind, as an invaluable friend—one who they may consult, whether in the midst of their active duties, or in the quiet of their offices or homes, with sure satisfaction and advantage. The Almanack, Diary, and Cash Account pages, prefixed to the general contents of the pocket-book, add to its usefulness, and make it in all respects *worthy* the pocket of the engineer and man of business.

◆

The Engineer's, Architect's, and Contractor's Pocket-Book. London: Lockwood and Co., Stationers'-hall-court, E.C.

In these days, when science is assuming her rightful sway over every branch of industry, and when it is necessary for practical men to comprehend "the reason why" this or that result follows this or that cause, such works as the one under review are of especial value. They are the "Guides, Philosophers, and Friends" whose assistance cannot be neglected by those who are engaged in undertakings which have for their object the material improvement of the country, without serious damage to themselves and the work they have in hand. It is an excellent feature in the "Engineer's, Architect's, and Contractor's Pocket-Book" that it gives *in extenso* a copy of the memorandum-book of Telford. This in itself, indeed, forms a *vade mecum* for the engineer and architect, and is another proof of the care, perseverance, and method which led that great and good man from his cradle among the sheepfolds of Eskdale to an honourable grave, at a ripe age, in Westminster Abbey. Although Telford filled his memorandum-book at a time when applied science had made far less progress among the people of England than it now happily has, there is yet an infinite amount of available information in it for the guidance of those whom it may concern.

The Pocket-Book contains an excellent essay on sewers, treats of hydraulics in a sensible manner, and as regards its treatment of architecture and engineering generally, leaves little to be desired. Able hands have evidently been engaged in its compilation, and they have striven to make their work acceptable—as it deserves to be, to those to whom it is especially addressed.

◆

The Popular Science Review. London: Robert Hardwicke, Piccadilly.

The second number of this review contains articles on Caverns, the Lowest Forms of Life, the Flower Animalculæ, Cotton, Grasses, the Reflex Theory and Dr. Marshall Hall, Solar Chemistry, Optical Phenomena of the Atmosphere, and a great deal of miscellaneous matter. The following is a sample of the number:—

"Applied Chemistry.—Gorup-Besamez informs us that ozone, when properly employed, is a most effective agent for restoring books or prints which have become brown by age. His process is to place a bit of phosphorus in a wide-necked glass carboy, and pour on it as much water as will nearly, not quite, cover it. The jar is then closed with a cork, and allowed to stand from twelve to eighteen hours. At the end of that time, the air in the jar is strongly impregnated with ozone. Then, without removing the phosphorus, or water, the engraving to be restored is moistened with water, and being rolled up, it is hung in the middle of the vessel by a piece of platinum wire, and left at rest. In a little time all the parts of the paper not covered by ink are rendered white; it is then removed, and carefully washed with water containing a little soda.

"Our juvenile readers will, doubtless, feel considerable interest in some recent researches by Professor Plateau on the figures assumed by a liquid mass when the action of gravitation is removed; not, however, for the sake of the curious theoretical conclusions at which he has arrived, although these are very remarkable, as for a practical hint which his paper contains, and which they will doubtless not be slow to put into practice. The Professor had discovered that some of the experiments, which he had hitherto been able to try only with great difficulty upon liquid media, inclosed in other liquids of the same density, could be readily performed in the air by forming the liquids into thin films; by converting them into 'soap-bubbles,' in fact. It was, however, necessary that some more stable kind of bubble should be obtained than the one with which we are all familiar, and which rarely lasts two minutes; and after much trouble the following liquid was prepared:—One part, by weight of Marseilles soap, previously cut into thin shavings, is to be dissolved by heat in forty parts of distilled water, and the mixture filtered after cooling. When this is effected, three volumes of this liquid are mixed, by violent and continued agitation, with two volumes of glycerine; it is then allowed to stand. The liquid, which is at first clear, begins in a short time to grow turbid, and after some days a white precipitate will be seen to have risen to the top of the liquid. Draw this off with a syphon, and preserve in a stoppered bottle for use. If a bubble be blown with this liquid, by means of a common tobacco-pipe, one may readily be obtained, four inches in diameter, and if this be supported upon an iron ring, one and a half inches across (previously wetted with the *glyceric liquid*), it will remain unbroken for three hours or more in the open air of the room; and for three days even, if protected under a glass shade. There is a peculiar charm in the contemplation of these figures—so slender, almost reduced to mathematical surfaces—which make their appearance accompanied by the most brilliant colours, and which, in spite of their extreme frailness, endure for so long a time."

The California *Farmer* states that the wool clip for the present year in that State will not fall much short of four million pounds.

INDELIBLE WRITING.[*]

As a preliminary to the experiments I shall have the honour to lay before you, it will, perhaps, be proper to define, or at least try to define, what is meant by the term "indelible" applied to writing; and also to put before you the principles upon which the experiments have been based.

If by the term "indelible" when applied to writing we are to understand indestructible, we are simply speaking nonsense, for we have no means, and can have no means, of producing any such thing. Were we to engrave upon diamonds, two of them could be rubbed together till both were smoothly polished; and was there only one in existence, it could be crushed into powder or burned into carbonic acid gas. By "indelible," then, we do not mean "indestructible" in the absolute unconditional sense of the word. But if a writing can be produced, which, if let alone, will resist through a long indefinite period, obliteration by those forces we call "time," and which will also resist obliteration by all the means man possesses short of the destruction of that whereon the writing is made, then we will have an indelible writing in the only possible meaning of the word as it is used.

The knowledge derived from the examination of old writings tells us that of all known substances carbon, in its black amorphous form, is best fitted to give us an enduring record of man's mind and actions. There is something wonderful about this carbon. It looks as if formed with the design to give us an enduring record of life and power, of action and of mind. In the long past era of our earth—long ages before man was created—it took the living form impressed upon it; and now, when all else that went with it has perished, it at this hour, in our fossils gives us a universal hieroglyphic record of the past, which may be read and understood by men of every tongue. And to each and all it speaks of "life" and all which that involves. What it did then it does now; it speaks of life still; existence seems bound up with it. It enters into all the proximate constituents of plants and animals; and so enters, that the chemist, in dealing with organic compounds, may substitute almost anything else for the hydrogen, oxygen, or nitrogen which they contain, and yet leave the type of the original untouched. But the carbon will submit to no such extrusion; it must abide, or an altogether new substance will be the result. It may have been choice, it may have been what we call accident, but men have, from a very early period employed it as a means to convey into the future the history of their transactions. And it has faithfully fulfilled their intentions, for the ruins of Assyria, Egypt, Greece, Italy, unite in giving up to us, with all its original characteristics, the black carbon which the old writers used in their caligraphy; three or four thousand years may have passed away, but it abides. The scientific men of our own time justify the choice of carbon, and point it out as the only material fit to give us indelible writing. In that they may be mistaken; another substance better fitted may exist; but at present such is not known, and the first principle upon which the experiments soon to be put before you were made is, that carbon must be the means employed to give us an endurable written language.

The second principle is, that the carbon must be imbedded into the substance of the paper, and not merely laid upon its surface. That it must be in the paper in such a way that it shall constitute an integral part, not to be removed unless the substance of the paper goes with it. We will now endeavour to show how these two principles were attempted to be carried out by means of three well-known facts.

The first of those facts is, that all paper contains carbon; the second that the carbon can be eliminated in the paper by heat and a few chemical re-agents; and the third is, that a platina wire can, by galvanism, be made red-hot. Putting these together, it occurred to me that by using the wire so heated as a pen upon ordinary paper, the carbon would thereby be evolved from it, and that the wire pen would leave behind it an indelible record of its progress, and so fulfil all the required conditions. Pen and paper alone would thus constitute the whole materials needed.

My friend, and our worthy member, Mr. P. Stevenson, made the first attempt to carry out the idea. He was successful in producing a very indelible writing indeed, inasmuch as the letters were burned quite through. It was found, however, that with a hot pen and a particular speed, writing could be made without going through the paper; but a very little observation soon showed that the heat and the speed would require to be so accurately, yet at different times so differently, adjusted to one another, as to make the mode useless.

The next thing done was to try thicker paper, and that, imbued with various vegetable substances, easily decomposed by heat. Thinnish cards were chosen; it was found that writing on the unprepared face of the card was easy, but the pen cut deep; and the presence of the organic substances did not appear to make much difference in the degree of heat required.

After those failures, several varieties of paper were prepared, by pasting sheets of different kinds together, either with lamp black or tinfoil between; and some other sheets had tinfoil laid upon the surface. All these were prepared in order to prevent the leaf written on from being burned through, and in the expectation, if the upper surface of the paper should suffer from the heat, that then a black legible writing should appear. The experiments made upon them were not favourable; but two facts of some importance came out of them. It was found that brown paper gave a legible writing with far more ease, and much more like common writing, than anything else yet tried. It was also found that the tinfoil when written on melted, and left an engraven writing upon the paper; the tinfoil was cut, or, rather, melted out. This last fact was, for the present, laid aside; it may become useful for some purposes.

Finding that brown paper answered best, trials were made with papers of various thicknesses, and amongst them one was found giving excellent results. On it writing was made from time to time with a hot wire pen quite legible—though certainly not so much so as ordinary writing—and which refuses to be obliterated save by the most violent means, and not altogether even then. Here we must pause a moment upon the merits of brown paper. The only objection which can be brought against it is, that it is unsightly. Perhaps it is; but here we think the æsthetic ought to give place to the useful. The small quantity of tar left in brown paper serves a fourfold good purpose; it makes the writing easier and more readable, it is obnoxious to insects; and it is antiseptic—helping to preserve the paper from the effects of damp. A more uniform pulp, and an even, smooth, though not polished surface, is all it needs to give us an excellent material for indelible writing.[*]

Going back to our experiments, though not in order as regards point of time, we will finish those made with the hot wire. From the very first much annoyance was received from the galvanic pen, if we may give it that name. The wire bent too easily; it was ill to adapt, and difficult to use, getting hot in the hand. The battery also got out of order; connections were melted, faulty jars set the acids overflowing, &c., &c. After trying to mend matters, and some internal vicious grumbling, all those difficulties led to the questioning,

---

[*] Read before the Royal Scottish Society of Arts by Mr. D. R. Brown

[*] Since this was written, trials have been made with the hot pen upon woollen paper and on vellum. The first writes black, and easily; but the danger from insects is an objection to its use. The vellum does not burn easily, and yet it is very easily burned through; to write upon it with the hot pen demands the utmost care. But further experiments with it are yet needed before anything decisive can be said.

It is only a thin wire, will nothing else answer? Is it not possible to heat it some other way? A minute jet of gas was tried—it failed. Then a thin iron wire was inserted in the flame of a very small jet of gas, and the point of the wire used as a pen. This last answered so well as to give encouragement, and a thick copper wire, having a blunt round point, and having a single coil near the point, was substituted for it. Using the round edge of the coil to write with, it was found to answer better than anything yet tried. Contrary to expectation, it was found that the jet of gas might, with perfect safety, be brought all but in contact with the paper. To do so was, indeed, advantageous, as it not only warmed the paper and left the wire less to do, but also enabled me to bring the wire somewhat over the flame, and thus it was more thoroughly heated, and a double advantage gained. The copper, however, soon became oxidized, and another improvement was made by replacing the copper wire with one of platina much thinner. It was sooner heated, gave a better writing, and kept quite clean. No doubt the pen remains open to many improvements. Having thus given the experiments made to eliminate the carbon from the paper by heat alone, we have now to give an account of the other method proposed, namely, by means of chemical agents.

Among the substances known to chemists two offered themselves to notice as worthy of a trial; both of them most energetic in overturning almost all organic compounds, and setting their carbon free. Destructives they were held to be, yet it might be that for our purpose that was their good property. A solution of phosphorus in bisulphuret of carbon was one, and strong sulphuric acid was the other. Any one who has had the pleasure of hearing our worthy vice-president, Dr. Stevenson Macadam, lecture on carbon, and of seeing his beautiful experiments, will have no doubt of the capability of either to eliminate black carbon. The solution of phosphorus, however, must be dismissed for being too energetic. A stream of this solution, by no means saturated, flowing from the orifice of a tube, estimated about the [illegible]th of an inch in diameter, gave broad black lines more than a quarter of an inch across. It permeates on every side, and is so violent in its action that the thickest paper and strong thick card is carbonized through to the back. Besides, it is a most dangerous substance to work with. Means may, perhaps, be found to control it and render it useful, but for the reason stated it was set aside. We now come to sulphuric acid.

The acid used was the ordinary acid of the shops, of specific gravity 1825·1830, or thereby, and free from all solid particles, so that the fine bore of the tube employed to write with might not get choked. The bore of the tube used as the pen may be as fine almost as it can be made, but with strong sides, so as to resist even considerable force. The acid goes a long way in filling up the paper; a very few minims will fill a large page. Precautions in dealing with such a corrosive fluid are necessary, and will suggest themselves to everybody who knows what oil of vitriol is.

When first written with the sulphuric acid does not bring out the dark carbon; and if, after being written with, it is left in the paper, it spreads, and the whole writing becomes one blurred, watery-looking blot. But if written with on good thick brown or white paper, and then, some time within half an hour after, a moderate heat be given to the sheet by holding it near a decent fire, a deep black writing is in a second or two produced or developed. The same result follows, though perhaps not so perfectly, if the paper be slightly warm when written upon. The written sheet, when thus produced, may be washed in water, in aqua potassæ, nitric acid, and in chlorine water, without effacing the writing; but if put into a milk of bleaching-powder the black writing disappears; yet it leaves its marks behind it, in deeply cut lines in the paper, wherever it has been. Looked at through a glass of no great power, these lines are seen in all their integrity, and they may be filled up again with any coloured powder, by sprinkling it over the paper, and brushing off what remains on the surface; in fact, the acid has engraven the paper, giving deep, well-defined canals, out of which the carbon and all else have been removed. So sharp are these lines, that it seems possible the use of sulphuric acid on a properly adapted paper may serve some of the purposes of the engraver. They can be drawn with all the ease and speed employed in using a pen or pencil, and they look as if it would not be difficult to get a cast out of them. It may very reasonably be asked, why bleaching-powder should thus act, while free chlorine has almost no effect? The answer seems to be, that the excess of acid left in the paper reacts upon the proximate constituents of the bleaching-powder — namely, hypochlorite of lime and chloride of calcium—setting free both hypochlorous and hydrochloric acids as gases, which, as they escape, lift up the carbonised paper and shoulder it out of its place; the formation of sulphate of lime may also have something to do with it. The action seems to be mechanical; for if we first wash the paper well before we put it into bleaching-powder, the effect produced is very slight; we might from that fact be led to believe, that by simply washing the paper we should escape the only chance of obliteration. But no; for if the explanation given be correct, it would be easy to soak the paper either with an alkali or an acid, and to evolve carbonic acid in it, and then the mechanical effort of the escaping gas would lift up the carbonised lines out from the substance of the paper. It is right, however, to say, that the writing is not easily deprived of its carbonaceous markings; it took rubbing and beating under a stream of warm water to bring them out. Various suggestions might be made as to the possibility of preventing this evil, but none of them offer anything like certainty.

Objections may be urged against the use of sulphuric acid; it is corrosive and destructive to many things likely to come in contact with it; it is colourless, and the progress of the writing is not seen. The reply to the first is, that we must take things as we find them and make the most of them; it is its destructive power, as we call it, which makes it useful. So far as the free use of it is concerned, no other precautions were taken than to wipe well the outside of the tube, and when not in use to lay it down with the capillary end lowest; so dealt with, no annoyance was occasioned by it. Less than ten minims will fill a large page; it goes far, so that a comparatively small tube will hold enough almost for a day's work; with ordinary care, therefore, the risk is small. The second objection, that it is colourless, is met by the fact that it can be easily coloured by many substances. But it is well to notice here, that there must be nothing added to it which may choke the tube; solid particles in the tube or in the acid will make their use very troublesome, and may lead to accidents; a clean tube and clean acid are both indispensable. The most serious objection against the use of sulphuric acid, as a writing material, lies in the destruction it would afterwards occasion if left in the paper, and in the difficulty of getting it out. Certainly a considerable portion of the acid is so much destroyed, as to be effete for any purpose save to attract moisture; but that is so serious an evil that a remedy must be found; fortunately it is not far to seek. Washing with water removes nearly the whole acid, and a steep in some weak alkaline solution would neutralize it *in toto*. All this is of course troublesome; and it remains to be seen if the object sought be worth that trouble or no. One is apt to say, that if a thing be worth keeping for a thousand years, or thereby, some pains in preparing it ought to be taken.

In the first part of this communication it was mentioned that cards had been embued with a variety of carbon compounds. That was done in the hope of finding one so easily decomposed by heat, that it might be used, either as an ink, and then to be developed by heat, or, being first in the paper, decomposed by the hot wire used as a pen. Some experiments tend to show, that it is not impossible some such substances may exist at present, however, no more can be said about them.

And now to sum up. So far as experiment has yet gone, heat appears to give the best result. Sulphuric acid possesses the good property, that it can be used very much in the same way, and with the same freedom, as ordinary ink; it also gives a much better defined and blacker writing than the hot wire. But the hot wire gives a writing which, when the heat has been full enough, refuses to be altogether effaced by any means yet tried; so much cannot be said of the sulphuric acid manuscripts. It would be wrong, however, at present to pronounce the wire writing quite indelible. By the heat employed, the carbon of the paper is not wholly evolved in its black amorphous form; it partially assumes that intermediate condition, in which it has lost the white colour it has, or gives, or helps to give—for we know nothing about it—when combined, and takes on the deep-brown hue, which is so common an accompaniment of the oxidation of carbon compounds. When in that condition, it is sometimes soluble in water—as for instance in molasses, and sometimes not, as in tar; but in either state it can very easily be destroyed by chemical means. In some such condition it partially exists in the paper, after the passage over it of the hot wire for experiment shows that chemical substances do carry some of it away. It is of importance, therefore, to use as full a heat as we safely can. Improvements on the paper and pen, may, in time, give us all the advantages of the sulphuric acid,

It may be proper here to mention, that the time taken to fill a page with the hot-wire pen is not quite double that taken to write the same number of words with ordinary pen and ink.

Before concluding, it may be stated that a portion of this communication has been written with the wire heated by galvanism; another with the wire heated by the jet of gas; a third with sulphuric acid, then heated and left a written; a fourth, with the same acid, then heated and washed in water; a fifth, similarly treated as the fourth, but in addition, soaked in, and well washed with weak ammonia, and then in water; and yet a sixth, written with Dr Stark's ink.

In conclusion, this communication has been thus crudely brought before you that others, possessed of more leisure, and better means, may enter further into the subject. Nothing is ever brought to perfection by one man's labour; in perfecting small matters as well as great, man needs his brother.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

ECONOMY IN RAISING AND USING STEAM.

AT the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41 Corporation-street, Manchester, on Tuesday, December 31st, 1861, Hugh Mason, Esq., Vice-President, in the chair; Mr. L. E. Fletcher, chief engineer, presented his monthly report, from which we take the following brief extracts:—

"During the past month 256 engines have been examined, and 364 boilers, 10 of the latter having been examined specially, 4 internally, 38 thoroughly, and 311 externally, in which the following defects have been found:—Fracture 5, (1 dangerous); corrosion, 29 (3 dangerous); safety valves out of order, 9; water gauges, 4; pressure gauges, 2; blow-off taps, 13 (1 dangerous); fusible plugs, 5; furnaces out of shape, 6; (total, 73 (5 dangerous). Boilers without glass water gauges, 22; pressure gauges, 4; blow-off taps, 18; feed back-pressure valves, 38.

"No explosion has happened to any boiler under the inspection of this association during the past month, nor in fact throughout the whole year. A few cases of injury to furnaces have occurred, arising from deficiency of water, consequent on the derangement of the glass water gauges, which would have been prevented had there been two gauges to each boiler, so frequently recommended. In another case, injury arose from the attendant lighting a fire in his boiler when empty, while in another, from a defective blow-up tap. There has however come to my knowledge, in a casual way, the occurrence in various parts of the kingdom during the past year, of no less than twenty explosions, from which twenty-seven persons have been killed and forty-seven wounded, the boilers in question being of every variety,—factory, colliery, marine, locomotive, agricultural, &c.

"Relative to 'economy in the raising and use of steam,' I have brought before the attention of the members during the past year the importance of surface blowing out, and the advantage to be derived from steam jackets, as well as from superheating. Surface blowing out is in very general use elsewhere, and found successful; it is not monopolised by patents, but is free to all. The use of steam jackets and superheated steam, aided by surface condensation (a subject on which I shall take an early opportunity of communicating with the members), are now working a perfect revolution in marine engine economy, and are extensively adopted by various large steam navigation companies. In the report of the last annual meeting of the Peninsular and Oriental Steam Navigation Company, the chairman stated that in a new vessel called the 'Mooltan,' of 2,600 tons burthen, having engines of 400 nominal horse-power, in which the above principles had been adopted, the consumption of fuel had been reduced to rather less than one half the usual amount; and the chairman added, that the shareholders would readily perceive the importance of such a reduction in the consumption of fuel, when he reminded them that they had paid as much as £800,000 for coal in one year. It seems to me the very province of this association to circulate reliable information on such points as these—carefully avoiding, of course, at all times the recommendation of anything untried and experimental. In this way I am convinced that the association will continue to be a source of wealth to its members, as well as to the surrounding district; and I am desirous that no year should pass without a decided mark of engineering progress being clearly stamped upon it by the association. Surface blowing out is now being adopted by several of our members; superheating is being introduced, and steam jackets, so long undervalued, are being revived. I shall take the earliest opportunity of ascertaining full results of their working, and of disseminating this information throughout the entire body of our members."

LECTURES ON THE METALLURGY OF COPPER AND ZINC.

A valuable course of lectures has recently been delivered at the Museum of Economic Geology, Jermyn-street, by Dr. Percy, on the Metallurgy of Copper and Zinc. The lectures, which were addressed exclusively to working men, were very well attended. The *Ironmonger*, from which we take the following report, says, "The whole of the tickets, 600 in number, were disposed of before the first lecture, a very satisfactory proof that there exists among the artizans of the metropolis a demand for mental food of a solid and satisfactory character."

First Lecture.

Dr. Percy commenced by stating that he regarded it as more desirable to study one or two metals carefully than a larger number more superficially, and that he therefore selected copper and zinc. The metal copper is remarkably distinguished by being the only one of a red tint (the so-called red metal titanium having been ascertained to be a compound of titanium and nitrogen). Copper is the most malleable of all the ordinary metals, and is fusible, or melts, at a degree of heat between the melting points of silver and gold. It remains unchanged for any length of time in dry air at ordinary temperatures, but when moisture is present it rusts, forming an oxide, which uniting with carbonic acid forms a green carbonate of copper. At a red heat it unites with oxygen, being converted into *scale* or red oxide of copper; this when heated to a higher temperature, absorbs more oxygen from the air, and becomes black oxide of copper. This black oxide is a base of the salts of copper, such as blue vitriol or sulphate of copper, and on the addition of an alkali to a solution of these salts, the black oxide is precipitated in combination with water as a blue hydrate. If ammonia is employed in large excess, this is dissolved, with the formation of an exquisite blue colour.

Melted with glass these two oxides give very different results, the red oxide imparts a very fine red colour, the black a bluish green.

Copper readily enters into combination with sulphur, especially if the union is aided by heat, when the mixture becomes red hot, and a sulphide of copper is formed; if the sulphide is heated in the open air, the sulphur it contains burns away, and by regulating the amount of air, the temperature, and the rate of combustion, the process can be so managed as to leave pure copper, or oxide of copper, or sulphate of copper.

The formation of oxide of copper by heating the sulphide is the basis of all copper smelting operations. The general principle of the processes may be thus stated: common copper ores consist of sulphides of copper, or compounds of copper and sulphur; these, when heated in the air, may be converted into oxide of copper. When this is again heated with some sulphide of copper which has not been acted upon, the oxygen of the oxide and the sulphur of the sulphide unite, and form sulphurous acid, which passes away as a pernicious gas, and the copper of both remains.

When copper is kept melted for some time in the open air, its properties are materially altered; it becomes what is termed *dried* copper. This change arises from a quantity of the oxide being dissolved by the copper, sometimes as much as even 13 per cent. *Dried* copper is brittle, has a purplish red tinge when broken, and if cast, the ingot, or casting, has a furrow on the top, from the metal shrinking as it becomes solid. This *dryness* can be removed by the addition of charcoal, wood, or any deoxidising agent at a red heat; but, if too long heated with charcoal, the copper acquires singular properties, the ingot is brittle, and, when broken, shows an orange fracture and peculiar cavities; instead of having a depression or furrow on the upper surface, there is a ridge or prominence the whole length of the ingot; copper in this condition is said to be *over poled*. Between these two extremes is a medium quality, which possesses the maximum toughness that the metal is capable of possessing, and the ordinary colour.

Casting in pure copper is a difficult operation, as the metal generally protrudes, and the casting is unsound; there are, however, several substances that produce sound castings when added even in very small quantities to the melted copper; amongst others, may be mentioned, tin, zinc, metallic arsenic, and phosphorus.

The consideration of the intricate reactions attendant on the various processes required for the reduction of the different ores of copper to the metallic state, occupied the remainder of the lecture.

Second Lecture.

The second lecture of this course was occupied almost exclusively with the chemical changes arising in the several stages of the smelting, considerations which, however interesting in themselves, do not appear to us so well adapted to the auditors assembled as more technical details respecting the working properties and qualities of the metal. Several facts of considerable importance were noticed incidentally.

Dr. Percy described some ingenious contrivances for utilizing small coal. In France, furnaces of steam-engines have been constructed with bars, placed three-eighths of an inch apart, at the top, each bar being five inches deep and half an inch wide above, and one-quarter of an inch wide below. In some parts of Germany, small coal is used in furnaces having what is termed a step-grate, the bars being broad on the upper surfaces, and placed one above the other, as shown in the following diagram, which represents the bars, as seen in a section, from the front of the furnace to the back.

In this case it is obvious that the small coal would rest on the bars without falling through, though the air would have free access to the burning fuel. These step-grates are evidently worth the most careful consideration of English engineers.

In describing the wasteful results arising from ignorance of the composition of the various products of metallurgic operations, Dr. Percy stated that the slag from the refining furnace was formerly thrown away, though containing 90 per cent. of copper; and that in the dock-yards, in the waste arising from the melting of the old copper sheathing, hundreds of tons of copper had been consigned to the dust heap. As a parallel case, it was stated that the black dust that is formed in the manufacture of tin plates was, until recently, wasted, although containing about 60 per cent. of metallic tin.

Third Lecture.

The qualities of the different varieties of copper formed the subject of the commencement of Dr. Percy's third lecture. Copper possessing a silky fracture of a salmon red colour, usually has the valuable qualities of tenacity and malleability developed to the highest extent; the exact quality of the metal cannot, however, be ascertained in all cases by the fracture, as very different qualities may show a fracture of precisely the same character.

As an illustration of this fact, it was mentioned that the copper supplied to the Government dock-yards was formerly tested solely by the appearance of the fracture, and that on one occasion, when a large quantity was rejected, the smelter received it back, and, after having melted it with such precautions as ensured its having a different fracture, returned it to the dock-yard, when it was at once accepted.

The effect of the presence of small portions of other metals in altering the character of copper was dwelt upon. Tin, as shown in the new bronze coinage, increasing its hardness, but naturally lessening its malleability and ductility. The presence of lead to the extent of from one-quarter per cent. to three-eighths per cent. has a very marked influence in increasing its power of being drawn into fine wires, or rolled into sheets. Copper with this portion of lead is known as tough cake or rolling copper.

Dr. Percy stated that he did not consider any material improvement had been effected in copper smelting for the last twenty years, and that all the patents that had been taken out for so-called improvements were, in reality worthless, not one of them having succeeded in standing the test of actual fracture.

The smelting operations of the various continental and other nations were described at length, but did not offer any suggestions of much practical value, with the exception of the Japanese. The copper from Japan is received in small bars, often of the most exquisitely beautiful ruby tints, which are evidently owing to a thin layer of the red oxide on the outer surface.

In making a series of experiments on this subject, Dr. Percy found that fused copper could be most readily cast in water, and that without any danger of explosion or inconvenience from the escape of steam.

Dr. Percy's method consisted of placing a number of horizontal bars of iron parallel to one another, so as to form a sort of coarse gridiron, with the angles of the bars upwards and downwards. Over this was laid a piece of coarse stout canvas, which, on being depressed, formed a series of gutters or troughs between the bars; these gutters were then partially filled with water, the canvas being sufficiently retentive to prevent its rapid percolation; this being done, the melted metal is poured into the gutters, where it flows along the bottom of the water and consolidates into a solid bar. This casting under water is in itself interesting, but the circumstances attending it are no less so; in Dr. Percy's experiments he found that perfectly pure copper assumed, under these conditions, the colour of brass, owing evidently to the formation of some thin film of oxide on the outer surface.

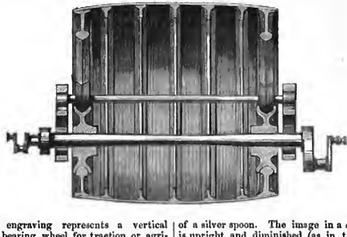
(To be concluded in our next.)

SCIENCE A CIVILIZER.

Dr. J. Bullar at a recent meeting of the Southampton Microscopical Society, said:—"The social aspect of our society commends it. It is a pleasant way of spending an evening where there is a scientific object of natural interest, and, at the same time, a social gathering of many having the same tastes and objects, and, therefore, the same sympathies. The anatomy of an insect, too, is a more harmless occupation than the minute dissection of a neighbour's natural history. Tea and coffee, pleasant chat with those of like tastes, and then the table covered with microscopes and specimens explained by one and passed round for each to examine, calling out animated talk on subjects worth discussing, or a short paper read and discussed on the subject illustrated, are civilizing. For science is a civilizer. It refines the tastes and elevates the thoughts, as it is the search after truth for truth's own sake. And in this age, when the progress of the nation and of the world is estimated by the money-value of exports and imports (and in this aspect the world's progress is prodigious and annually increasing), the danger must lie in estimating all things in reference to money rather than to truth. Now, science is a counteracting force. It neither brings wealth to its true cultivators, nor can wealth buy scientific tastes or scientific fame. It belongs to a higher region than 'the diggings.' It must breathe 'a purer ether, a diviner air.' And those who are engrossed in commerce would often do well, for their own content and happiness, by seeking in the recreations of science a complete change of action, thought, and feeling. Obviously the eye service which the microscope requires, trains the eye to minute and discriminative observation, and the hand to delicate accuracy. It leads on, if used scientifically, to the improvement of the scientific powers. The memory, the investigation of causes, the estimation of evidence, the power of distinguishing and of generalizing may be called into activity. But the mind has other and deeper needs than these. The senses lead to the awakening and culture of deeper powers inherent in the soul itself, and the microscope may excite and cultivate, not only the sense of the true, but of the beautiful. Constable, the landscape-painter, said that, pictorially, nothing in nature was ugly; and surely we may say the same microscopically. The higher the magnifying powers, the more minutely extensive the investigations, the more beauty do we see. Even in the unhealthy secretions—in what look to the unscientific eye like repulsive fluids, in the very disorganisations which slowly ruin this goodly human frame, the microscope discovers forms of the highest geometrical accuracy, as well as of the most delicate beauty. And this beauty and consummate finish are everywhere, and are found farther and deeper as our powers increase of observing them. Here, too, at every step we find the limitation of our own powers, and the illimitable field of nature; the infinite contrasting with the finite, teaching us 'the moral lesson of science —humility.'"

Messrs. Alexander Chaplin and Co., of Cranston Hill Engine Works, Glasgow, the well-known manufacturers of Chaplin's patent portable steam cranes and engines, are building a depot at Lambeth Wharf, where they purpose keeping a stock of their manufactures.

STEVENS'S BROAD WHEEL FOR TRACTION ENGINES.



The above engraving represents a vertical section of a bearing wheel for traction or agricultural engines, the invention of Mr. B. F. Stevens, of Trafalgar Square. The drum is intended to be of a length nearly equal to the inside width of the frame, to secure the broadest possible tread, and making it, by preference, slightly barrel shaped, so that it may turn easily. The interior of the drum is furnished with flanged rails, upon which run wheels having a rim corresponding in shape to the rails, and to these wheels the main driving shaft is secured. The drum is held in position when running by means of guide rollers, flanged similarly to the others.

LECTURES ON LIGHT.

Professor Tyndall commenced his course of lectures on light (adapted to an educated juvenile auditory) on Thursday, the 26th of December last, at the Royal Institution.

The construction of the electric lamp was first explained, and its powerful light exhibited in a magnificent ray, which afforded invaluable aid in the elucidation of a great number of interesting phenomena. The subjects of the day's lecture were the propagation, velocity, and reflection of light. The professor stated that it had been proved by computation that light travelled through space at the rate of 192,000 miles in a second, and that it came to us from the sun in seven minutes and a half, while it would take a cannon-ball fifteen years to perform the journey. An express train, travelling night and day, would require three weeks to go round the earth; light would do it in the interval between two puffs of the engine. That light moves in straight lines was shown, and the divergent and convergent shadows of spheres of various sizes, and in various positions, were also shown and explained. The reflection of light occupied the concluding part of the lecture. When light strikes an unpolished surface it is dispersed in all directions; when it strikes a polished surface or mirror it is reflected regularly, according to the angle at which the surface is struck. The great law, that the "angle of incidence is equal to the angle of reflection," was illustrated by balls on a bagatelle board, and exhibited by rays of light; and many experiments were made by means of plain, concave, and convex mirrors, elucidating the principles of the construction of the kaleidoscope and other optical instruments.

The Second Lecture (on Saturday, the 28th of December) began with some further experiments with concave and convex mirrors. The image of an object placed between the principal focus and the surface of a concave spherical mirror was shown to be erect and magnified, and behind the mirror, while that placed beyond the centre of the sphere to which the mirror belongs was formed in front of the mirror between the focus and the centre, but inverted and diminished, as is observed when looking at the concave surface of a silver spoon. The image in a *convex* mirror is upright and diminished (as in the back of a silver spoon). The phenomena of the refraction of light was explained and exhibited in a variety of ways. When a ray of light falls perpendicularly on a solid or liquid it goes straight into it, whereas when the ray strikes the surface obliquely it is so bent as to approach the perpendicular, and when passing from the solid or liquid the ray is bent from the perpendicular. This bending of the ray (refraction) was shown in glass, liquids, and gases. In consequence of refraction the immersed end of a straight stick thrust obliquely into the water appeared higher than it really was, and some water in a basin looked at obliquely appeared shallower than it really was, as is the case also with lakes and rivers. Bodies refract light in very different degrees. The diamond owes its brilliancy to its being nearly the most powerful refractor as well as reflector known. Lenses were next considered. Double convex lenses (in a pair of spectacles for the aged) were shown to be convergent, the rays of light being concentrated and brought to a focus, while the double concave lenses (in spectacles for near-sighted people) were shown to be divergent, the rays of light being dispersed outside the rims. Many interesting experiments were made with larger lenses, showing their properties, and the beautiful phenomena to which their employment gives rise.

The Third Lecture (on Tuesday, the 31st of December) began with some further illustrations of the refraction of light. It was shown that, is two bodies refract a ray of light equally, one cannot be seen within the other. The eyeball of an ox, for instance, vanishes in the water, the refractive power of each being the same. In optics the body which refracts most is termed the densest. Spirit of turpentine, which is lighter or less dense than water, refracts more than it, and is thus optically denser. It was explained that a ray of light passing from a denser medium to a rarer, may be so refracted as just to graze the surface. All such rays as strike the surface at such an angle as not to get out are totally reflected. This may be seen in a glass of water, and was beautifully shown by a jet of water illuminated by the electric light, the effect being heightened by employing coloured glasses. The principle of the magic lantern and camera obscura was next explained and illustrated; amongst other examples, by exhibiting the crystallization of a solution of sal ammoniac. By means of a large model and diagrams, the structure of the human eye was shown, and its principal optical parts explained—viz., the aqueous humour, the crystalline lens, the vitreous humour, and the retina. The causes of long and short sight were also pointed out; and it was experimentally shown that our retina receives inverted impressions of the objects seen. By means of the light of the electric lamp and of the induction coil it was also shown that the action of light upon the eye does not subside the moment the light ceases. In some cases the impression endures a quarter of a second after the light has ceased to shine. Thus a flame may be moved round so rapidly as to give the appearance of a ring of light.

SPECIFICATIONS OF PATENTS.

The following is an extract from the Ninth Annual Report to the Council of the city of Manchester on the working of the public free libraries:—

The references to the Specifications of Patents for the year have amounted to 31,103, being an increase upon the preceding year of 1,862.

The following is a statement of the total number of reference to the Specifications from 1857 inclusive:—

		References.
Total number of references,	1856-57	20,877
" "	1857-58	27,856
" "	1858-59	36,972
" "	1859-60	29,241
" "	1860-61	31,103
		146,049

Amongst the specifications inquired after, the following are given as examples:—

Subjects referred to.	No. of References.
Textile fabrics and processes connected therewith	10,096
Steam and steam-engines	2,481
Gas manufacture	1,458
Railways and railway rolling stock	1,304
Sewing machines	1,275
Metals and metallic substances	1,060
Engraving and printing	708
Oleaginous substances	582
Water and other fluids, conducting and filtering	573
Building materials and processes	502
Telegraphs and signals	500
Dyeing and colouring	483
Motive power and propulsion	81
Miscellaneous	9,950
Total	31,103

THE MACHINERY DEPARTMENT OF THE EXHIBITION OF 1862.

Classes 5, 7, 8, and 10.

No. I.

The business of the machinery department, in classes 5, 7, 8, and 10, is, perhaps, the most onerous of all the business of the classes into which the industrial products are to be distributed for Exhibition.

The supply of steam, to work the numerous machines which are to be in motion, is to be furnished from a number of large double-flue boilers, 30 feet in length, of 50 nominal horse power each, to be supplied by Messrs. Hick and Sons, of Bolton, sufficiently powerful to work the whole of the machinery in motion at once, without any necessity for stopping any portion of it, or of working parts of the machinery alternately. The disadvantage of an under-supply of steam in former exhibitions was strongly felt, and it has been the aim of Her Majesty's Commissioners, in this particular, to have an ample supply of steam for every demand, without restriction. The steam from the boilers, which is to be of 70 lbs. pressure per square inch, will be conveyed through large pipes down the passages of the western annex, which is to contain all the machinery in motion; the extent of steam pipe will be unprecedented in engineering practice. The annex is nearly 1,000 feet in length from north to south, and the boiler-house will be built at a distance of at least 100 feet from the north end, near the Kensington-road. There will be two lengths of pipe about 900 feet each, and a third and shorter length, which, with the junctions required, will amount to a total length of upwards of 2,500 feet, for the ramification of steam pressure throughout the annex. It is not intended by Her Majesty's Commissioners to erect steam engines specially for the services, but to make free use of the numerous and various steam engines which will be exhibited, the intending exhibitors of which generally are desirous to have them put in motion. The steam pipe will be provided with expansion-boxes at frequent intervals, to take up the unavoidable expansion and contraction of metal pipes subjected to heat and cold alternately, and they will be thickly clothed in felt, and bedded in ashes, sand, or other non-conducting substance, so as to prevent loss of heat by radiation and condensation of steam within the pipe. Such a provision, though essential and highly important, is by no means so difficult to mature as appears to have been assumed by certain writers for the press; indeed, the proportion of steam lost by condensation may be reduced to a very small fraction, by the expedient of superheating it before it leaves the boiler-house, and drain cisterns will be provided at suitable spots for the reception and collection of the water precipitating within the pipes.

The exhaust steam, discharged from the numerous steam engines at work in the annex, will be intercepted by large return exhaust pipes, laid parallel to the steam pipes, and conducted back to the shaft or chimney attached to the boiler-house, into which it will be discharged. Thus, the whole operation of the steam, conducted to the steam engines and back again, will be conducted without noise or nuisance; and the spectacle which would otherwise be presented of numberless clouds of spent steam escaping from the various engines through the roof of the annex according to the usual routine of workshops, will be wholly prevented. The exhaust pipe, like the steam pipe, will be fitted with expansion-joints and drain-cisterns.

The gross area of the western annex is little more than four acres, or about 180,000 square feet; of this area 16,000 square feet are to be set apart for branch refreshment rooms, about 70,000 square feet for the exhibition of foreign machinery, and about 90,000 square feet for the machinery of the United Kingdom. An additional area of 20,000 square feet will probably be reserved in the eastern annex for the exhibition of machinery.—*Society of Arts Journal.*

NOTES ON THE INTERNATIONAL EXHIBITION.

The following minute of the Art Designs Committee of the International Exhibition of 1862 has been forwarded to us for publication: "Her Majesty's Commissioners for the Exhibition, being desirous of exhibiting the progress of art designs for manufactures, would be glad to receive contributions from possessors of drawings and models by British artists executed within the century 1762-1862. Artists, designers, and manufacturers in general are hereby invited to send works, suitably framed and glazed, or if of large size, on strainers, properly prepared for hanging. Designs in all departments of art industry capable of reproduction are admissible in this class. Designs for glass and ceramic wares, precious and other metals, furniture and carving, plastic decorations, and other objects in relief; also designs for textile fabrics, paper-hangings, mural decorations, tiles, mosaics, inlays, stained, painted, and decorated glass, &c. Assistance from the possessors of drawings and models by such artists as Chambers, Adams, Soane, Stothard, Flaxman, Pitts, Pugin, Wyon, and others, is especially desired; and the committee trust that the holders of such works will communicate with the secretary as early as convenient. Illuminations of an original character will be admitted into this department. All works must be delivered for the inspection of the committee, on or before the 31st of March, at the South Kensington Museum (office entrance)."

Her Majesty's Commissioners are still engaged in receiving notices of acceptance by British Exhibitors of the space allotted to them. Against such allotments, it is understood that 2,500 appeals have been lodged, a number about 250 times as great as that in the Exhibition of 1851. Arrangements are also being made to secure for exhibition, in the nave and transepts, trophies of the productions of the most eminent British manufacturers.

Her Majesty's Commissioners and the Council of the Royal Horticultural Society have entered into arrangements, by which it is agreed that the price of a season ticket of free admission to both the Horticultural Gardens and the Exhibition, shall be five guineas.

The Japan Government has actually entered into the great undertaking, and has officially signified its intention of displaying specimens of the produce of that wonderful country which, until lately, has always been jealously preserved from foreign influences. Our consul has received most satisfactory letters from the Ministers of Foreign Affairs, who glory in the jaw-breaking names of Koodze Yamatonokami, and Ando Tsoo Tsoosima Nokami. These worthies, instead of wishing to keep Japanese products out of the world's show, say that "it would be a matter of great joy to cause the glory of Japan to sparkle in a foreign country."

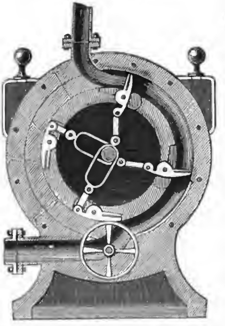
From Canada, says the *Morning Star*, Sir William Logan intends to send a complete collection of minerals, and the different boards of agriculture are now engaged in collecting the finest specimens of the produce of the soil. Newfoundland, the only one of the North American colonies which did not apply for space at first, has now decided to make a display, and a commission of six members of the Legislature has been appointed to make the necessary arrangements. The beautiful collection of objects formed at Prince Edward's Island is said to be on its way to England. The chief feature of the Nova Scotia display will be a section of the coal strata of that colony, which will be 30 feet high, with a base of 140 square feet. The West Indian colonies, which were at first so lukewarm, are now making great preparations, and most of the islands will be well represented. The African settlement of Gaboon will make an attractive display of ivory, timbers, and native mats and arms. Thirty splendid picked teeth (tusks), and billets of ebony, bar-wood and camwood, will be included in the collection. The Australian colonies will send collections which would together fill the entire building, and the Commissioners are puzzled to know what to do with the objects which they will be compelled to reject. Among the objects for which places in the Exhibition must be found, the Tasmanian timber trophy will perhaps be the most striking. This will have an elevation of 55 feet clear of the pediment, and will be formed of baulks of timber and polished planks arranged round a central spar 90 or 100 feet high. Besides timber, jaws of the sperm-whale, and two whaling boats with their gear, will be included in this splendid trophy.

In France the Imperial Commissioners have succeeded in producing a magnificent selection of French industry. In order to set off to advantage their exhibition, they have determined to spare no expense in decoration. Every portion of space occupied by France, whether in the picture galleries or in the industrial sections, is to be carpeted. Mirrors and girandoles will be hung in every available position, and the great court which has been assigned to them in the south-western part of the building will be hung with curtains stretched from column to column, shutting off this portion from the rest of the building, and, in effect, rendering it a distinct exhibition.

Postal Communication with France.—The Journal of the Society of Arts, says,: Under the provisions of a new postal convention recently concluded with France, on the 1st January, 1862, and thenceforward, patterns of merchandise (such patterns being in themselves of no intrinsic value), may be transmitted by post between the United Kingdom and France and Algeria under the same regulations that are applicable to, and at the same reduced rates of postage that are chargeable upon printed papers.

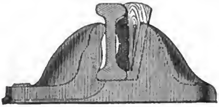
The Resistance, 18,000-horse power, is to be furnished with iron masts similar to those supplied to the Defence. Her bowsprit will also be of iron, and will be so constructed as to enable it to be drawn in and out, similar to a telescope.

HUDSON'S ROTARY ENGINE.



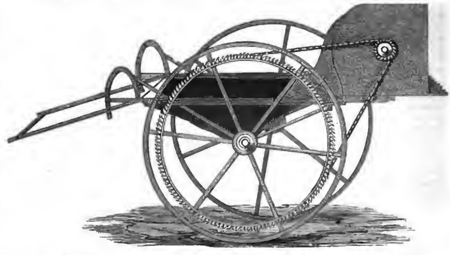
THE above engraving shows a sectional elevation of rotary engine, recently protected by letters patent, as a communication to Mr. B. Hudson, of Gloucester Terrace, Regent's Park. The invention consists in applying steam in a manner to cause direct rotation; it consists of a circular case, having in its interior a fixed solid ring, the object of this ring is to force the current of steam always in the same direction. An eccentric wheel is placed in the case, supported on an axle, to which riggers and a fly wheel may be attached for communicating motion to machinery, this wheel is furnished with four flaps, connected in pairs to the axle, as shown. As the steam impinges against one of the flaps, the wheel is caused to travel round, until the next flap reaches the opening, when that flap is forced onward by the pressure of the steam in the same direction. Each flap, when it has passed the outlet for the steam, is caused to fold to and lie within the periphery of the wheel.

ASHCROFT'S PATENT RAILWAY CHAIRS AND FASTENERS.



MR. P. ASHCROFT, the engineer to the South Eastern Railway, has just patented an improvement in chairs and fastenings, as represented in the above engraving. The object being to form one of the jaws of a railway chair with an inclined inner face in the direction from the top to the bottom, in order to receive a wedge vertically between the inclined inner face of the chair and, a filling piece interposed between the jaw of the chair and the web of the rail, and such wedge is prevented moving sideways by means of ledges or projections formed on the inner face of the jaw between which the wedge is driven. The filling piece is made of cast or wrought iron, and is formed on one side to fit the hollow of the rail (or rails, if it be in a joint chair), and on the other side it is formed with angular grooves and ridges, so that when a wood or other soft wedge is driven in between the jaw of the chair and the filling piece the wedge will become grooved on that face which is in contact with the filling piece, and the other side of the wedge will become similarly grooved where it comes against the jaw of the chair, by reason of the inner inclined face of the jaw of the chair being also formed with angular ridges and grooves; by this means the wedge and the filling piece will be prevented moving sideways, whilst the wedge being driven vertically will at all times have a tendency to descend in the space between the jaw of the chair and the filling piece.

GOREL'S COMBINED REAPING AND THRASHING MACHINE.



GOREL'S COMBINED REAPING AND THRASHING MACHINE.

THIS invention, by M. Gorel, of Bourges, France, has for its object the taking up and cutting off the ears of corn and other grain, beating them during the travel of the machine as they are taken off, and conducting the grain into a receiver, which is emptied by the conductor at every journey. The comb or cutter of such machine can be placed, by a system of rocking axle, in the necessary plane, according to the height of the grain to be gathered in.

The machine is constructed as above represented. Upon two suitably-sized wheels is mounted the thrasher or beater, which is composed of a shaft or axle provided with arms, to which are attached a suitable number of beaters, and cutting blades. Such apparatus is mounted in a box, and is made to revolve, by means of an endless chain working round a wheel attached to one of the driving wheels of the machine, and passing round a small chain wheel working on an axle outside the box. The height of the comb is regulated by means of two racks attached to the framework of the machine, and which follow the movement of the axles. The comb is supported on a table, and is covered with plates or blades; the whole being covered in with a metallic gauze covering. The handle, by which the machine is pushed along, can be regulated to suit the height of the attendant by means of a couple of segment pieces.

To put the machine into operation, the attendant pushes the apparatus before him, when the blades of the comb coming in contact with the ears of corn seize and tear them off by the impulsive force given to them by the attendant. The grain which falls into the box is threshed out by the beater, and falls into the cloth or receiver, whence it is passed into sacks. The straw remaining behind is afterwards cut by a suitable machine.

The International Exhibition of 1862 Guarantee Fund amounts to £442,950. The deed still lies at the house of the Society of Arts, and may be signed by gentlemen who have given in their names as guarantors, as well as others interested in the Exhibition.

NATIONAL RIFLE ASSOCIATION.

WE have before us the report of the National Rifle Association for 1861, which shows a vast improvement in the financial condition of the society over that of 1860, resulting from the success of the last Wimbledon meeting. The report contains much valuable information, particularly to the 175,000 volunteers of the United Kingdom. In addition to the statistical account of the Wimbledon contest, and financial statement, it contains the rules and bye-laws which govern the working of the council and committee. The title page of the report is faced with a plan of Wimbledon common and its approaches, showing the various positions of the targets, and from 100 up to 1000 yards range. We take the following interesting part from the pages of the report. "On comparing the plan of the butts at Wimbledon with that which accompanied the History and Proceedings, 1860, it will be seen that great changes and improvements were made in the arrangement and laying out of the ground; the area of the enclosure was extended so as to embrace the windmill, which formed a striking central object; and near this the principal entrances for foot passengers, the officers of the association, the refreshments tents, and the tents of the gun-makers were placed. The ground here being sound, dry, and intersected by gravel roads, and commanding a beautiful view of Richmond Park, offered advantages possessed by no other part of the common. On the right of the windmill the encampment of the metropolitan police was established, and this part of the common was likewise open to such volunteers as chose to pitch their tents and camp on the common; but the Victoria Rifles and Lord Radstock alone availed themselves of the opportunity thus afforded. Next year, however, it is hoped, many volunteers may be induced to camp on the common during the meeting, as it would be a greater economy and convenience to them. The site of the camp is on a dry and most picturesque spot, and the council hope to be able to provide the volunteers with tents for the occasion. They believe that such an encampment would, if once established, become a popular feature at the annual Wimbledon meeting, and be of use in initiating the volunteers in the mysteries and contrivances of camp life. The Guards' camp was at the further extremity of the common, near the Wimbledon entrance. Here, previous to the meeting, there was a fatigue party of Coldstream Guards, under the command of Captain Fremantle and Lieutenant Dawson, who were for days engaged in preparing the ground, butts, &c., for the coming meeting; and the council would here point out how greatly the association is indebted for the valuable and hearty assistance thus rendered. This camp was subsequently occupied by the sergeants and men of the Hythe School of

Musketry, and by marking parties of the Guards, the whole being under the command of Colonel Steele, whose services in all the military arrangements were of special value to the council. The only other feature in the arrangement of the tents which differed from last year, was a row of tents near the entrance, occupied by the different gunmakers, and the prize exhibition tent, which attracted much notice and admiration."

HUMPHRYS' IRON FORTS AND BATTERIES.

Fig. 1.

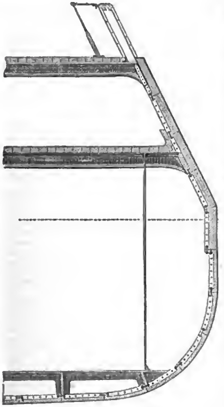
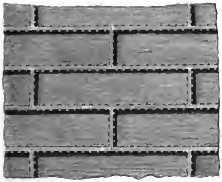


Fig. 2.

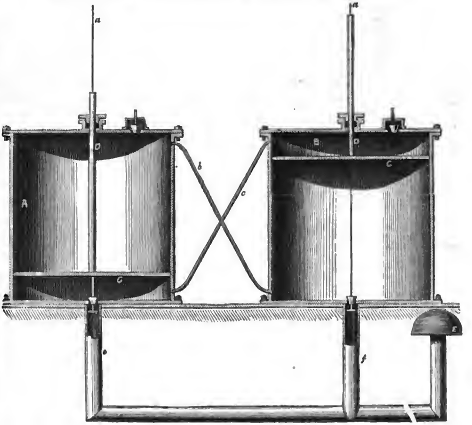


Mr. E. Humphrys, engineer, of Deptford, has just patented an improvement in building iron ships, batteries, and forts, entirely, or in part, of solid plates or forgings of iron with internal flanges. The plates are so formed as to admit of their being bolted together on the internal surface, whereby, in the case of ships, the usual frames of angle iron may be dispensed with, and in the case of batteries and forts, structures of great strength may be formed.

Fig. 1 of the above engraving represents in cross section a portion of a ship built on this plan; Fig. 2 is an internal view of part thereof, showing the arrangement of the flanges all round the inboard edges of the plates.

The flanges are so formed on the armour or other plates, either all around their inboard edges or on their horizontal edges only, or on their vertical edges only, and where such flanges are omitted both plates are grooved, a steel bar or tongue being inserted into such groove.

ROY'S NEW DOUBLE-ACTING AIR PUMP.



A NEW DOUBLE-ACTING AIR PUMP.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In experiments with the air pump, an extreme degree of exhaustive power is frequently of less importance than rapidity of action. This is so well known to all who work with the air pump as to require no illustration. In the following description, it will be seen from the annexed engraving that in this double pump the air in both barrels is discharged at every stroke of the pistons. *A B* represents two pump barrels, fitted with pistons *C C*; the pistons are carried up and down by their respective rods *D*, which are hollow, and each of them have an inside rod *a* fitted air tight into each of the piston rods, which works air tight through the stuffing-boxes, at the top of the barrels. The inside rods are connected to conical valves at the bottom of the barrels, and with a catch below, so that when the pistons are raised the rods are carried up and open the valves, and shut them when they are depressed. In the top of the pump barrels there are other conical valves affixed to small rods passing up through the top of a box filled with oil. The upper and under surfaces of the pistons are supposed to be ground so as to apply as closely as possible to the inner part of the top and bottom of the pump barrels. Cross pipes *b c* of about the thickness of an ordinary knitting wire are supposed to be fixed air tight into the top of the barrels and fixed in like manner into the bottom of the opposite barrels; spaces in the barrels are left equal to the thickness of the pistons. Into the bottoms of the barrels suitable pipes, *e f*, are fixed, communicating with the receiver *E*.

Observe, now, the action of this pump. Both barrels are supposed to have exactly the same length of stroke. It does not matter whether their capacities be the same or not; suppose the piston in the right hand barrel to be at the top, while that in the left hand barrel is at the bottom; then both barrels are filled with air from the receiver *E*. Upon depressing the piston in the right hand barrel, and raising the other, air in both barrels is expelled by the valves in the cover of the barrel, and both barrels are again filled with air from the receiver, the right hand barrel above, and the left hand barrel below the pistons. Reverse the strokes of the pistons, and all this air is driven out through the valve in the cover of the right hand barrel. When the barrels are again filled with air from *E*. It is needless to continue the description further, as the intelligent reader will see that at every stroke of the pistons the air in both barrels is expelled through the valves alternately, both when the piston in either barrel ascends, or descends. The valves in the covers are supposed when they take their seats to fall a little below; when those are raised to the top they will open the valves and let the air out. The boxes over these valves are supposed to be filled with oil, to prevent the access of air during the descent of the corresponding pistons, as well as to lubricate these pistons. The catches prevent the valves from missing their seats in the working of the pump. In the sides of the pump barrels between the pipes *b* and *c*, and the points of insertion of these pipes and the bottoms of the barrels, a small cut must be made in each, to enable all the air between the descending pistons and bottoms to escape. The limit of the exhausting power of a pump of this kind, is given by the ratio between the capacity of one of the cross pipes *b* or *c* and that of the contents of both pump barrels, as the density of the air in *b* or *c* can never exceed that of the atmosphere. OY.

P. rrels ter
and of ing

power will be $\frac{1}{15}$ of the atmospheric pressure; but this is an under estimate, for when the one piston is at the top of its barrel and the other at the bottom, the air in the cross pipe from the top to the bottom expands to fill both barrels, and is limited in its density by the density of the air in the receiver. The limiting power of the pump depends, therefore, upon the air left above the ascending piston and the top of the corresponding pump barrel when said piston reaches the top, which can never be more than that of the atmosphere for the time being. Hence the density of the air in the receiver may be made indefinitely small.[*] A. R.

Shipping Office, Dundee.

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, Dec. 24.—J. P. Joule, LL.D., President, in the Chair.

Mr. Brockbank exhibited some samples of steel manufactured by Mr. Bessemer's process. These specimens had been bent and twisted cold, and showed a remarkable degree of ductility. He stated that the Bessemer steel was one of the most plastic and manageable of metals—more so even than copper. It could be bent, flanged or twisted, either hot or cold, without annealing, and over a considerable range of temperature—which is not the case with ordinary steel or copper. A plate of 18 inches diameter had been forced through a series of dies until it formed a tube 13 feet long and 1¼ inches diameter, without any crack or flaw. A ring of metal could, at one heat, be hammered into a die to form a locomotive engine chimney top. In drilling a circular hole into a plate continuous shavings are formed—whereas, in copper or Low Moor plates, or any other metal, the shavings break into pieces $\frac{3}{16}$ in. long. Thin sheets of the Bessemer soft steel can be bent backwards and forwards hundreds of times without a fracture, and are almost as flexible as paper.

A paper was read by Mr. Baxendell, F.R.A.S., "On the influence of the seasons on the rate of decrease of the temperature of the atmosphere with increase of height, in different latitudes of Europe and Asia."

The determination of the laws of the distribution of heat in the different strata of the atmosphere under various circumstances of season, locality, direction of the wind, barometric pressure, &c., is one of the most important, and, at the same time, one of the most difficult problems which can engage the attention of the meteorologist. Notwithstanding the labours of many able meteorologists and physicists, several points of considerable importance to the future progress of meteorology are still involved in doubt and obscurity; and the necessity for further inquiries has been so generally acknowledged, that at the late meeting of the British Association in this city, a grant of £200 was renewed to defray the expenses of balloon ascents, to be undertaken for the purpose of obtaining additional data, of a reliable character, to serve as a basis for future investigations. The author, therefore, thought it might be worth while to submit to the society some results which, although confessedly imperfect, seem to him to indicate very clearly the existence of a law of distribution of temperature in the higher regions of the atmosphere in the different seasons in different latitudes of Europe and Asia, which appears to have hitherto escaped notice, and which seems likely to have an important bearing upon many interesting questions in meteorology.

From numerous observations made at elevated stations in Europe and India, it has been concluded, 1st,—That the general rate of decrease of the temperature of the atmosphere with increase of height, is least in low, and greatest in high latitudes; and 2nd, —That the rate of decrease is greatest in the summer and least in the winter months. Some results, however, which the author obtained in the course of an investigation of the relations which exist between falls of rain and changes in the decrement of temperature on ascending in the atmosphere, and of barometric pressure, in different localities, led him to doubt the general correctness of the second of these conclusions, and he has therefore examined all the observations that were accessible to him which seemed likely to throw any light on the subject; and from the results which he has obtained, he shows that there exists in the temperate latitudes of Europe and Asia a belt or zone in which the decrease of temperature, for a given ascent in the atmosphere, is greatest in the winter months, while at stations north or south of this belt, so far at least as observations have yet been made, the decrease is greatest in the summer months.

This belt passes over Portugal, Spain, Sicily, Southern Italy, the Caucasian provinces, and Southern Siberia; and at places lying within it the changes of temperature produced by change of season are greater in the higher than in the lower strata of the atmosphere; while, on the contrary, at places north or south of the belt the changes of temperature are greatest in the lower strata. The details of the results are given in the paper, and all the temperatures are reduced to Fahrenheit's scale, and the differences of elevation to English feet.

The great changes of temperature which take place in the higher strata of the atmosphere in the belt, indicate a less capacity for heat and a greater degree of dryness of the air in these strata than in the corresponding strata beyond the belt. The author was therefore led to conclude that the ratios of the quantities of rain falling on the mountain and on the plain would be less at places in the belt than in other localities; and the results which he has given of the comparisons of the mean annual amounts of rain-fall at different stations fully bear out this conclusion. Comparisons are also made of the falls of rain during the winter and summer halves of the year; and it is shown that at places in the belt the ratio of the quantity falling on the mountain to that falling on the plain is greater in the summer than in the winter half of the year, while on the contrary, at places beyond the belt, it is greatest in the winter half.

The author then draws attention to some results which appear to indicate that the annual rate of decrease of temperature, on ascending in the atmosphere, is subject to a periodical change. Comparing Geneva and Milan with the Great St. Bernard, the annual rate for the years 1848—58 exhibits, with but trifling irregularities, a gradual increase up to the beginning of the year 1854, and afterwards a gradual decrease. The differences of temperature between the two stations Bywell and Allenheads, in Northumberland, at a difference of elevation of 1273 feet, also show a progressive increase from 4·14° in 1858, to 5·07° in 1860. The author remarks that the epoch when the rate of decrease was at a maximum, as shown by the Geneva and Great St. Bernard observations, corresponds exactly with the epoch of minimum magnetic disturbance, as determined by General Sabine from the magnetical observations made at the colonial observatories and at Pekin; and he shows that there is some probability that the period of the change in the rate of decrease also corresponds with the period of magnetic disturbance.

In concluding, the author tenders his grateful acknowledgements to Mr. Vernon, F.R.A.S., for the valuable assistance he has rendered him in procuring data, and in referring to original publications for the purpose of clearing up doubtful points; and he also remarks that without the means of reference afforded by the many valuable volumes of meteorological observations now in the Society's library, it would have been quite impossible to have undertaken an inquiry of this nature.

BAROMETERS: THEIR CONSTRUCTION, USE, AND RECENT IMPROVEMENTS.

A Lecture[*] delivered by Mr. R. Strachan, at the British Horological Institute.

(*Continued from page 296, Vol. VI.*)

It is very common to find barometers erroneous. Mr. Hartnup, the astronomer of Liverpool, frequently verifies barometers for captains at that port, and he has found them, in some instances, nearly an inch in error, some reading too high and some too low, an amount of much consequence in observations used for scientific purposes, and the logs of ships are now often consulted to aid philosophical inquiries. Some have been found so bad that the mercury would not descend lower than 29 or 28½ inches. The marine barometer should be capable of showing at least 27 inches. The value of a barometer at sea is to show depressions which foretell storms; but if the mercury cannot descend, how are persons to be warned against the coming evil? Many cases of a similar nature have come under my knowledge. The way in which the fault may be detected is by captains bringing their instruments to the observatory to be verified. Means have been provided for obtaining artificial pressure; they are put into into an air-tight case, with a glass front; the air is pumped away, and the mercury is brought down as low as required,—so low as 10 inches it *could* be brought. Many barometers have been found which by no possible means would read lower than 29 or 28½ inches, owing to the smallness of their cisterns, which would not permit of a sufficient descent. Hence the necessity of having each instrument verified with a standard. Again, the mercury may be made to stand higher by forcing air into the chamber; and thus marine barometers are compared with a standard from 31 to 27 inches, beyond which limits the column never ranges at the sea level.

It is necessary to apply certain corrections to barometer readings, if they are used scientifically. Mercury is affected very much by changes of temperature. It is one of the most expansible metals; therefore if one barometer was read at a temperature of 80° and another at 32°, there would be a difference. Observations intended for scientific purposes should be reduced to 32° Fahr. Then, again, there are barometers without movable cisterns, or movable scales; allowance then must be made for capacity. Also correction must be made for the action of capillarity. When a tube is plunged in water it has a tendency to draw a little into it. The tube appears to suck up the liquid to a certain extent. But when the tube is put in mercury, it presses out. This is called capillary action, and an allowance must be made for it in barometers, because it has the effect of depressing the column of mercury.

The ordinary mode of fitting a barometer is by putting it in a wooden case. The French prefer this method, because they think it can be more securely fixed, is more portable, and less liable to be broken by a sudden concussion than if fitted in metal. The English opticians, on the other hand, think differently. They contend that the wood is liable to irregular expansion; that the tube cannot be securely fixed in it; and that all things considered, brass is the best material.

We have before us a specimen of a brass tube for a marine barometer. It is called "The Kew Model Barometer," because it was the form approved by the Kew Committee, which sat some years ago to consider the state of the science of meteorology. Moreover, it was recommended by the Congress of Brussels, held in 1853, with the view of promoting meteorological observations at sea, on a systematic plan. It is an instrument which has been extensively employed in the United States, by our own government, and by private shipowners. Captains prefer it on account of its portability, the readiness with which it can be put up and taken down, and for its accuracy. It is an exceedingly accurate instrument. It can be adjusted to the five hundredth part of an inch, and read to a thousandth. It can be set with great accuracy; for light is admissable to the top of the mercury by slits made in front and behind. Like almost all barometers it is read by means of a sliding vernier, moved along the scale by a rack and pinion motion. The lower part of the vernier is brought to the top of the mercury, so as just to shut out the light. No correction is required either for capacity or capillarity, it has simply an index error. The cistern not being adjustable, to do away with the correction for capacity, the inches of the scale instead of being true inches as usual, are shortened below the "neutral point" and lengthened above it in proportion to the diameter of the cistern to that of the tube. So accurately are they graduated, that, when compared with the Kew standard, the errors are determined to the thousandth part of an inch, and are very uniform and small. Mr. Adie invented this form of barometer, and generously refused to patent it. In consequence, they have been made in large numbers, and have been found of great utility on board ship, where they have preference to the wooden ones. I have known some of them to have been in use for five or six years uninjured, during which time they have been several times round the world. However, such is not always the case; in other hands they may be broken the first voyage. The durability of barometers very much depends upon the care of the persons who have their custody. Adie's may be sent with safety by railway: it can be packed very securely in a wooden box. With all its advantages, however, it has recently been superseded, to some extent, because it was found to require more care than could ordinarily be expected to be given to it by the commander of a ship. Seamen do not exactly understand the value of such nice accuracy as the thousandth part of an inch; but prefer an instrument that reads only to a hundredth part.

As regards the glass tube itself of barometers, an important modification has been used for some time, —by whom invented I know not. It is simply a "pipette," or small conical funnel, made in the inside of the tube, having its point downward. Its object is to arrest any air that may work in between the glass and the mercury. The bubble of air lodges at the shoulder and can go up no farther. It is one of those simple contrivances which turn out remarkably useful.

---

[*] Each piston when at the top of its barrel is understood cover and close the cross pipe b or c.

[*] It should be observed that this is a "lecture delivered," and not a "paper read" as stated in the first part of the report.

If any air gets into the tube it does not get to the top, and therefore does not vitiate the performance of the barometer.

It was advisable to construct a barometer as practically useful as possible for marine purposes. With that view Admiral Fitz Roy has contrived a barometer which can be set readily and read at a glance. That gentleman has given the following description of it in the "Ninth number of Meteorological Papers," published by the authority of the Board of Trade:—This marine barometer, for Her Majesty's service, is adapted likewise to *general* purposes. It differs from barometers made in points of detail rather than in principle:—1. The glass tube is packed with vulcanized india-rubber, which checks vibration from concussion, but does not hold it rigidly, or prevent expansion." The outer cistern is made to screw on; by simply unscrewing, the barometer itself is got at. One advantage of the plan is that the captain has a spare tube. If he happens to break the one in use he can replace it by the other; but, as it is securely packed with india-rubber, there is very little liability of its being broken by fair usage. Every person who knows the importance of the barometer on board ship, will acknowledge that the supplementary tube is a decided improvement, which will generally be adopted when the plan becomes known. "2. It does not oscillate, or pump, though extremely sensitive." Its contracted tube prevents it doing so. "3. The scale is porcelain, *very legible*, and not liable to change." Instead of being, as ordinarily, made of ivory or metal, it is porcelain, and besides the divisions of the inches, it has words of universal application in the interpretation of the barometer movements, engraved as legibly as they are expressed succinctly; and of which I will speak of again. "4. There is no iron anywhere to rust." The supporting case is brass throughout, and all the fittings are brass, without any iron whatever; because the conjunction of the two metals produces a galvanic action which is objectionable. "5. Every part can be unscrewed, examined, or cleaned, by any careful person. 6. There is a *spare* tube fixed in a cistern, filled with mercury, and *marked* for adjustment in this or any similar instrument." The chief value of the contrivance is the ease with which a tube can be replaced when broken, all of them being made alike:—like rifle balls, all are of the same size. In fitting the spare tube, all that is necessary is to observe that a mark on the glass coincides with 27 inches on the scale. "Although, for various reasons, these new barometers are graduated to hundredths *only*, they will be found accurate to *that* subdivision, the second decimal of an inch. They are packed with vulcanized india-rubber, in order that (by this and a peculiar strength of glass tube) guns may be fired near them without causing injury by ordinary concussion. It is hoped that all such instruments, for the Queen's service at sea, will be quite similar, so that *any* spare tube will fit *any* barometer." Many instruments of this description are afloat in the Royal Navy, and in a short time it may be expected that all the cases and tubes of barometers in the public service at sea will be similar in size and character; so that should a captain have the misfortune to get both his tubes broken, he would be able to borrow another from any ship he fell in with that had one to spare, which would be perfectly accurate, because it would have been verified before it was sent out.

On these new barometers appear strange words not resembling those upon ordinary instruments. The practice has been to place upon barometer scales such expressions as,—at 31 inches, "very dry"; 30·5, "settled fair"; 30, "fair"; 29·5, "changeable"; 29, "rain"; 28·5, "much rain"; and 28, "stormy." It requires no scientific knowledge to lead to the conclusion that these words are of little or no use. There was a storm lately with the glass at 29. There has been rain this month with the barometer not lower than 30. The whole of these words are nonsensical, because the barometer must of necessity vary in different localities. If a person happened to live several thousand feet above the sea level, on a mountain, the glass would never stand at 30 inches; and, consequently, according to the scale, he would never have fair weather. There is frequently quite different weather to that indicated by the scale, even at the sea-level, where the glass very seldom in this country gets down to 28 inches. These words have long been ridiculed by persons acquainted with the nature of the barometer fluctuations, nevertheless, opticians continue to place them on the scales, evidently only because they appear to add to the importance of the instruments in the eyes of those who have not learned their inutility. Admiral Fitz Roy's great experience,—as an observer in all parts of the world, and as the chief of the Meteorological Department of the Board of Trade, where are collected registers of weather observations made in almost all parts of the ocean,—combined with science, had led him to suggest a new system.

Before proceeding to consider the new system of words for barometer scales, I would ask attention to Professor Dove's law of the movements of the barometer with the gyration of the winds. Supposing a compass diagram, with the principal points laid down, the NE is the wind for which the barometer stands highest; for the SW wind it is lowest. This is found to be so in the great majority of cases; but there are exceptions to this, as to all rules. The NE and SW may therefore be regarded as the poles of the winds, being opposite each other. When the wind veers from the SW through W and N to NE the barometer gradually rises; on the contrary, when the wind veers from NE and E to SE, S and SW, the mercury falls. A similar curious law exists in relation to the veering of the wind and the action of the thermometer. Those who study barometers know that within the last three or four days the wind has veered completely round the compass, from N, through E, S and W to N; and that the barometer has been highest with N and NE winds, lowest with S and SW; but as regards the thermometer the NE wind brought the coldest weather, the SW the warmest. As the wind veers from the SW to W and N the thermometer falls; as it veers from NE to E and S it rises, because the wind gets from a colder to a warmer quarter.

(*To be concluded in our next.*)

MEETINGS FOR THE WEEK.

MON.—*Royal Geographical Soc.*, I. "Narrative of an Expedition to the Andaman Islands in 1857," by F. J. Mouat, Esq., M.D. II. "On the trade of the Eastern Archipelago, with New Guinea and its Islands," by A. R. Wallace, Esq., at 8.30 p.m.
Society of Engineers, "On the enclosure of Lands from the Sea, and the Construction of Sea and other Banks," by E. Olander, Esq., at 7 p.m.
London Inst., "On the Physics of Imponderable Matter," by Rev. A. Bath Power, M.A., at 7.

TUES.—*Inst. Civil Engineers*, I. "An Address," by J. Hawkshaw, Esq., President. II. Renewed Discussion upon Mr. Bailey Denton's Paper, "On the Discharge from Under-drainage," at 8 p.m.

WED.—*Society of Arts*, "Comparison of the year 1851 with 1861," by Blanchard Jerrold, Esq., at 8 p.m.

THUR.—*Royal Soc.*, at 8.30 p.m.
Linnean Soc., at 8 p.m.
Antiquaries, at 8.30 p.m.

FRI.—*Royal Inst.*, "On the Transmission of Heat through Gases," by Prof. Tyndall, F.R.S., at 9 p.m.
London Inst., "On the General Phenomena of Chymical Action, and the Laws which Govern them," by Henry Letheby, Esq., M.B., &c., at 7 p.m.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

THE CONNECTION OF RAILWAYS BETWEEN ENGLAND AND THE CONTINENT, INCLUDING INDIA.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—This great and momentous subject is now again being brought prominently (by the Press) before the public of England, and the continents of Europe and Asia, and it is most sincerely to be hoped that it will be practically recognized, and the best and most efficient plans for the most permanent and effective workings be selected and adopted for making one great chain of railway communication from England, through France, (or Belgium), Switzerland, Austria and Turkey, crossing the Bosphorus at Constantinople, and onward through Persia (near Ispahan) on to Hyderabad, and from thence to Calcutta, with branches to Bombay and Madras, connecting the three latter presidencies by a triangle. This must be done before many years, to develope the real advantages of our Indian possessions, which would be immensely benefitted, by one continuous line of rail, terminating in England, and not stopping on the other side of the Channel, as it must of necessity do, if a Channel railway (by tunnel or other means) is not constructed, and France (or Belgium) would then be continental termini, instead of England.

Many plans and projects have from time to time been laid before the public, and I entered the lists in 1856, see accompanying printed extracts from the *Times* of January 31, 1856, with my suggestions for constructing a treble arch tunnel with three double lines of railway under the bed of the Channel, from Dover to Calais, cut through the solid chalk and soft rock, and walled or lined with *indestructible masonry*, for iron or other *perishable* material would not be in any way advisable to use for works which should endure for ages, and be able to resist the shock of a train running off the rails, which no iron boiler plate tube could stand—especially if only submerged—for an express train would dash clean through the sides into the sea, if it ran off the rails. My attention has been given and careful reading of Mr. James Chalmers' plan for a boiler plate tunnel telescope tube, to carry *one* double line of railway, from Dover to Calais, and as he has invited criticism and suggests, "that others may have the pleasure of pointing out his defects," I have therefore ventured without prejudice or ill-feeling, to point out that which I consider very great defects and disadvantages, and MY plans are of course open to a like criticism, if you are disposed to republish the extract detail, in the MECHANICS' MAGAZINE.

In the first place, I consider an *iron tube* is not an advantageous material to be used where constant action of sea water must rapidly corrode and destroy it, by rust, and encrustation.

2nd. Admitting that it would not decay for 70 years, the very outside that could be calculated, would it be politic to use iron boiler plate, or any iron for a national highway, which would require a repetition of works every 60 or 70 years, but most probable would be every 40 years?

3rd. A double line of rail only would be useless for the great stream of continental railways. Three double lines would be as little as could be safe.

4th The construction of any tube or tunnel should be to have falling gradients from the centres to the shores, so as to get rid of drain or Channel waters, which will naturally collect by exhalations, and weeping small streams, through joints, fissures, &c., and not to have the *fall* from the shores to the centre, where the water could not be ejected so easily.

5th. The 264 flanged and bolted joints of the iron tubes, would be each and all at a constant risk of defect, which would be irremediable, and the whole rail channel would be filled up with the sea waters.

6th. Any man of war or large merchant ship dragging her anchors in a storm, across the tube and stone bank over it would tear it up and cause general destruction of the tube. It is two great a risk to run where so many thousands of lives would be daily exposed, to a not improbable or impossible accident, and such must be avoided.

7th. Nothing can be safer or more effectually permanent than an excavated rock tunnel, cut through at a sufficient depth under sea bed.

Respectfully yours,
W. AUSTIN, C.E.

◆

"WHO LIVE IN GLASS HOUSES SHOULD THROW NO STONES."

SIR,—Captain Rodman, of the United States navy, casts cannon ready bored by the set of casting, in the same manner as my patented plan, he, moreover, cools his cannon from *within*; this is an improvement on my patent; *The Scientific American* describes the construction of the Ericsson, a steel-clad floating battery for the defence of the harbour of New York; the sides of this battery could not be pierced by shot fired from any cannon in our service; but a shot fired from the 15-inch bore gun cast on the Rodman principle, would crush in the side of our steel-clad Warrior, when fired at the distance that Nelson loved to pour in his broadsides. How would Brighton with its princely buildings look after a few rounds of Rodman shells were thrown into it from a distance of five miles? Dublin is in the same danger, as well as many towns on the coasts of England, Ireland and Scotland. Shells can now be charged with liquid fire (phosphorus dissolved in bisulphide of carbon) the most "naufragous" fire stuff ever invented by the ingenuity of man. Captain Halsted, R. N., one of our very best authorities on naval armaments, has clearly stated that one shell charged with liquid fire is sufficient to destroy the largest line of battle ship. J. NORTON.

◆

THE EARLY DAYS OF BRITISH STEAM NAVIGATION.

SIR,—I send you herewith a few facts and scraps about the early days of British Steam Navigation from 1801 to 1821, some of which I believe are not generally known, and were found by me in vol. 14 of the Journal of the Philadelphia Franklin Institute for 1834, when looking over a series of them a short time since in our valuable public library in Melbourne. The writer in the journal was one who was intimately connected, as he states, with steam navigation on the Thames from 1814 to 1824. Vol. 15 which contains the conclusion of his narrative is missing, so that it terminates at 1821—but I apprehend I have seen the most valuable portion. At the risk of being thought guilty of needless repetition, I have added a brief resumé of what was done in steam navigation from 1801 to 1814, when the narrative in the journal commences, in order to make the sketch more complete. From 1821 to the present day the story of steam navigation has been very fully told, but not so prior to that period; although I cannot but believe in the existence of documents which would clear up some doubtful questions, and more fully illustrate many interesting experiments, of which we possess the most meagre information. When the lives of Sir M. J. Brunel and his equally remarkable son, who had a good deal to do with steam boats when in their infancy, are written, as I hope they will be before long, we may, perhaps, gain some additional information, and I should imagine the representatives of the late J. Watt, P. and J. Maudslay, have it in their power to contribute somewhat towards the same end. Yours truly,

SAMUEL DARTON.

1 Argyle-street, Southyarro, Near Melbourne,
October, 1861.

1801. The Charlotte Dundas, built on the Forth and Clyde Canal, at Lord Dundas's request, by Symington, tried successfully, but afterwards laid aside.

1803. Fulton tried a steam boat on the Seine after having seen that by Symington.

1805. Boulton and Watt, employed by Fulton to make an engine for the first American steamboat, Clermont.

1812. Henry Bell had built the Comet, by John Wood, of Port Glasgow, 25 tons burden, 40 feet long 10½ feet beam, 4 H. P., to run between Glasgow and Helensburgh. She attained a speed of 5 miles an hour, the engines were made by Anderson, Campbell, & Co., afterwards Anderson & Caird, and now Caird & Co. David Napier, then a workman in the establishment, was employed in manufacturing the boiler. The Elizabeth, built under direction of a Mr. Thomson, of Glasgow, was next started between that place and Greenock. The distance (27 miles) was performed twice a day in four hours. The dimensions of the Elizabeth were, length 58 feet, breadth 12 feet, depth 5 feet, tonnage 33 feet, H. P. 10. She was sent in 1814 to Liverpool.

1813. A Mr. Dawson introduced a steamer between Gravesend and London, but which was speedily withdrawn on account of the opposition it met with from the Thames watermen. It was sent to Spain to ply between Sanhucar and Seville.

1814. Cook, of Glasgow, constructed the Glasgow, of 16 H. P. Boulton & Watt made two pair of engines for two small boats on the Clyde, the Princess Charlotte and the Prince of Orange, of 8 H. P. each. The Margery, built by Wood, of Port Glasgow brought from Leith to London and put on the Gravesend station. She was 70 tons burden, 65 feet long, 12 feet beam. Her engine had a cylinder of 14 inches diameter, 3 feet stroke, with a common bell crank connection to the wheel shaft. Her paddle wheels were uncovered, and projected from the stern. The opposition she met with from the Thames watermen caused her speedy withdrawal, and her machinery being very defective, she was never able to run long without repairs. The Margery was afterwards sold to the French Government, for use on the Seine.

1815. The Thames, formerly the Argyle, arrived in London in June, having been navigated from the Clyde by a young engineer named Dodd, who bought her on account of some persons in London. The voyage, which was performed entirely under steam, excited great astonishment at the time. Dodd was the son of the original projector of Waterloo Bridge, and for a long time took a prominent part in steam navigation on the Thames. The first steam boats between London and Richmond, were fitted up by him, one of them, the Richmond packet, commenced running in 1814. The Thames was 70 tons burden, 79 feet long, 16 feet beam, 14 H. P., drew 4 feet water. Her engine, by Cook, consisted of a single vertical cylinder, 24 inches diameter, 3½ feet stroke, working by a bell crank connection with a fly wheel to the shaft, and a waggon-shaped boiler. She immediately commenced plying between London and Margate, making on an average the voyage in 12 hours. She proved a decidedly successful speculation for her owners, being greatly patronized by all classes, so that Dodd was soon engaged in the construction of another, to be called the Majestic. The Regent, built on the Thames by one Reedhead, for a gentleman of property named Hall, also made her appearance on the London and Margate station, and her history is thus amusingly told by the writer in the *Franklin Institute Journal.*

"The Regent was built on the Thames for a gentleman of property, named Hall, who long had an idea that steam would supersede sails. He had the misfortune to fall into the hands of one Reedhead, who had once been a coal fitter at Newcastle, and was for short time in the employ of an engineer in Newcastle, a Mr. Whinfield, who was the first that mounted a steam-engine upon wheels (?) to drag coal waggons upon a railroad from the pits to the vessel. Reedhead was altogether ignorant of mathematics, and the laws which govern motion and power of fluids. He had performed some service for Mr. Hall, and had gained his confidence so far, that he obtained the superintendence of the new steamer. She was about 80 feet long by 18 feet wide, and he persuaded the owner to build her with two trunks entering the bows, one each side the stern, and passing by the side of the keels on to an open scuttle in the bottom near the run abaft, which scuttle was surrounded by a watertight tank. In the scuttle was placed a paddlewheel, similar to those now used. The steam-engine which moved this wheel had a cylinder of 24 inch diameter and 4 feet stroke, with an overhead beam. The intended mode of propulsion was by drawing in the water from the bow and sending it against the aftermost side of the scuttle tank, and thence downward through the scuttle. But, on trying the engine, it was found the wheel was so deep in the water that the crank could not be got over the centre without the aid of a fly wheel. When this was applied, motion was obtained; but of so slow a rate as to be useless except to demonstrate to the fact that whatever motion the vessel had was stern foremost. In this dilemma, no alternative remained, but to do away with the tank, fill up the scuttles, and lengthen the wheel-shaft to receive wheels on the outside of the vessel. When this was done, Reedhead boasted the Regent would run 10 miles an hour, though while in his care she never reached four. In the month of August appeared the third steam vessel, the Defiance, built at Norwich by two scientific young engineers, Aggs and Curr. She was 73 feet by 12, and drew 3 feet, clinch built, and an excellent model for speed in smooth water or river way. She was fitted with two 10 inch horizontal cylinders, 3 feet stroke, working into rectangular crank pins on pinion wheels, gearing into large dress wheels on the paddle shaft. The paddlewheels were large in proportion, and the engines were supplied by cylinder boilers. The whole workmanship surpassed anything that had yet appeared afloat. The Defiance was put into the Margate trade, and had she been larger and better fitted for sea she would have given the Thames some trouble. But no one would go in so low a vessel when the lofty Thames was near. The Regent was put in the Margate trade as well; but a few weeks showed Reedhead's incapacity so strongly, that she was turned over to another superintendent, who soon showed the proprietor the gross error that had been committed, and it was determined to refit her in a proper way during the winter. Up to this time she had cost £8,000. During this year, Mr. Maudslay had built a small engine, to order, to propel a passage and baggage vessel between Ipswich and Harwich, which was entirely unsuccessful, owing to the ignorance of the manager, and not from any fault on the part of Mr. Maudslay. The refitting of the Regent, by Mr. I. Brunel's advice, was entrusted to Mr. Maudslay. In the same winter, 1815-16, Dodd had commenced the building of the Majestic, on nearly the same plan as the Thames. Length 85 feet, cylinder 30 inches diameter, 3 feet stroke, plain side valves, and common bell-crank connection. The Defiance had meanwhile been sold to go to Holland, in fulfilment of a patent granted to some Englishmen to navigate the rivers of that country by steam, and in 1816 she astonished the Dutch by her performances; but when, at the end of the year, an increase of accommodation had become requisite, a disagreement had arisen between the patentees, and on the vessel coming again to England for repairs, she was suffered to lie and decay for several years, and the patent was eventually forfeited by *non user.*

"1816. In June the Regent came out, with two 22 inch cylinders, and 32 inch stroke, and four way cock-valves, the engine working by a bell-crank motion, through a pair of rectangular cranks upon a pair of wheels 10 feet diameter, and 5 feet paddle-board dipping 20 inches, and making 28 revolutions per minute; the steam was generated in a square boiler with return flues, and the fire-places all within the water. Every part was made with the most careful consideration, to have no more weight than was needful to attain a moderate amount of surplus strength. With the boiler fitted, and coals on board, the vessel drew four feet four inch water, and previous calculations led to the belief she would reach about seven miles an hour, but on the first trial it was evident she would run eight, and could be depended upon to maintain it against a strong wind. She frequently beat the Thames by an hour, which had started an hour before her."

The Regent would appear to have been the *first successful vessel fitted by Maudslay,* her career was, however, not long, for she was unfortunately burn off Whitstable, in July, 1817.

"During the summer another Scotch vessel, the Caledonia, was brought round, and tried against the Regent, but proved altogether worthless, and was speedily withdrawn. The Regent took the first ship to sea that was ever towed by steam from London, this was the Oxford, Captain Lamb, bound to Bombay, 400 tons burden, drawing 14 feet. She was taken out of a tier of vessels from between two others, and carried off againgst a strong flood tide. The consumption of the Regent for a 10 hours' run was nearly 67 cwt.

In several accounts of the progress of steam navigation at this period, the Congou is mentioned as a vessel fitted by the British government for exploring a river of the same name in Africa, but none of the writers knew what became of her. Her history is thus amusingly told by the writer in the "Franklin Institute," and her failure may be said to have led to the adoption of the present side lever marine engine:—

"During the summer of 1816 the British Government had prepared a vessel called the Congou, under Lieut. Tuckey, for exploring a river of the same name, on the west coast of Africa, and employed Boulton and Watt to put an engine into her, which these gentlemen had made as a common overhead beam engine, with a waggon boiler. When finished, the Congou was too deep in the water by nearly three feet, the wheels so drowned they could scarcely move, and the whole matter so badly arranged that it was found absolutely necessary to take out both engine and boiler, and let the Congou do her best with the help of her sails. Among the junior officers in the Government dockyard at Deptford, where the Congou was fitted, the saying "*it is well to know what will not do,*" became a standing joke. Some of these young gentlemen furnished the writer with a few anecdotes on these points, so superlatively ludicrous that if repeated at the present day they would throw doubts upon the authenticity of the whole narrative.

"Mr. James Watt was now nearly 80 years of age, but he had been too well schooled, and had too much judgment to be defeated by a failure which arose principally from want of information among the government officers. Mr. Murdock, the undoubted inventor of the D slide valve, was at this period Mr. Watt's right hand man, and a Mr. James Brown was an assistant in the same concern, to say which it is enough to show that he was a man of talents. An old and meritorious officer in the British navy named Wager, was sailing master among the officers of the Warrior 74, the ship which conveyed the Prince of Orange home to Holland, in November, 1813, from which circumstance he became the leader among the parties concerned in the Dutch patent, under which the Defiance, as previously related, went to Holland. He had navigated her across the North Sea, and retained the charge of her while in Holland. The Defiance returning about this time under his command, he was introduced to Mr. Watt, and employed by him, to assist, with Messrs. Murdoch & Brown, in perfecting a marine steam engine. To aid in this object, the Caledonia, previously spoken of, was purchased, her old engines and boiler taken out, and a set of experiments instituted and pursued till August, 1817, at a cost of £10,000. These experiments led to a sealed plan of construction, by which marine engines were much improved. The Caledonia was a flat-floored vessel, length 94 feet, width 15 feet, depth 8 feet 6 inches. The form of her bows was very much that of the old-fashioned box iron used by house-wives. The after body was finished by as clean a run as could be given, from a flat bottom to the form of the stern known as the pink stern, and when completed by Mr. Watt, she drew 4 feet of water."

The writer here goes into a description of her engines, which, with a few exceptions, were very much the same as the ordinary side lever engine of the present day. It appears to me, that in mentioning Mr. Watt, he leaves it to be inferred that it was James Watt, sen., who was principally concerned in these experiments, whereas, as is well known, it was James Watt, jun. who took an active and personal part in them. Mr. Muirhead, in his life of Watt, tells us that Mr. Watt, jun. made in all 31 distinct trials with the Caledonia. Her average speed on the Thames was 8·33 miles per hour, and her two engines were of 14 H. P. each.

"In the autumn of 1817 the Caledonia went to Holland, leaving Margate, October 14, she arrived off West Capelle, Walcheren, in 24 hours 10 minutes, having been under steam at an average speed of 7½ knots per hour. She returned to England, but was afterwards sold to the celebrated Steen Bille, the Admiral who commanded the Danish fleet at Copenhagen during bold Nelson's attack, April, 1801, and by him was employed for some years as a government packet between Copenhagen and Kiel.

"1817. In this year occurred the most disastrous steam packet accident to the Courier (called in some accounts the Phœnix), built by Messrs. Agg & Curr, to run between Norwich and Yarmouth. She was fitted with high pressure engines, and on the 4th of April blew up, killing several persons. This disaster led to a parliamentary enquiry, and the prohibition of high pressure engines in steam vessels.

1818. Appeared Dodd's Victory, being 110 feet by 23 feet, fitted with two 30 inch cylinders, 3 feet stroke, acting each by a cross head and side rod, extending to two inverted bell crank beams, connected to a middle shaft, having a pair of right-angled cranks, one on each end; these were connected by a pair of crank links to the crank on the wheel shaft. The boiler was of a low waggon form, having two elliptical furnaces and upper flues returning to the chimney. The engine was planned by Dodd, and made by a Mr. Dickson, but does not appear to have given satisfaction." This year appeared also the Favourite, the first passenger vessel on the Thames, fitted by Messrs. Boulton and Watt with beam engines—the average time occupied by the Victory and Favourite in the run to Margate was 7 hours. The London Engineer, fitted by Maudslay, dated from this time, but the only record I can find of her is in Tredgold's "Steam Engine," where the following particulars are given—breadth 24 feet, draft 5 feet, diameter of wheels 12½ feet, breadth ditto 6½ feet, tonnage 315, H. P. 70, consumption per hour 630 lbs., diameter of cylinders 36 in. length of stroke 30 inches.

In this year David Napier started the Rob Roy, built by Denney, of Dumbarton, between Glasgow and Belfast. She was afterwards placed on the Dover and Calais station, and eventually sold to the French Government. She was 90 tons and 30 H. P. A small steamer, called the Brittania, is said in this year to have made the passage from Howth to Holyhead, but it is certain she was not continued on the station.

1819. David Napier started the Talbot, 180 tons, 60 H. P., between Holyhead and Howth.

1821. The City of Edinburgh—the largest steam ship yet built, and the longest voyage yet attempted, London to Leith—commenced. The City was built by Wigram, and fitted by Boulton and Watt—length 143 feet, breadth 25 feet 8 inches, diameter of wheels 18 ft., breadth ditto 8 feet, depth of floats 2 feet, tonnage 400, H. P. 80. The Sovereign and Meteor, built by Evans for the Post Office, and fitted by Messrs. Boulton and Watt, placed on the Holyhead and Howth station, as mail boat, and by far the best of their class as yet constructed; these have been so fully described by me in a former article, which appeared in your Magazine for 1850, that nothing further need be added. The Aaron Manby, the first iron steamer ever launched, built by Manby, being 120 by 18 feet, depth of floats 3 feet 6 inches, H. P. 80, was sent in this year, under the care of the late Sir Charles Napier, from London to Havre, to ply between the last place and Paris.

Scientific Gossip.

Lead Pipes.—Mr. J. R. Nicholas, an American chemist, says that leaden pipes are not acted upon by the water flowing through them at right angles. But whether this is due to the mechanical action of the water at the angle, or to a change in the structure of the lead, he does not say. It is however, certain that the lead corrodes more rapidly at the bends than at other places. It is therefore well that plumbers should twist the pipes supplied to houses as little as possible; and that turns should be made as gradual as circumstances may admit, and acute angles be avoided.

Residences of the Working Classes.—At the last meeting of the section for statistics and sociology of the Manchester Literary and Philosophical Society, Mr. Isaac Holden read a paper "On the Effects Produced by the character of their Residences upon the Physical and Moral Condition of the Working Classes." Mr. Holden believed that although considerable attention had been given to the building of cottages, sufficient progress had not yet been made in making them comfortable and attractive to the inmates. If this were done, it would contribute greatly towards furthering their domestic happiness, as they so frequently leave their homes seeking pleasure, instead of resting after their labours, cultivating their minds, and preparing themselves for their duties next day. The public has already been frequently told that the accommodation was insufficient for comfort and decency, and, he would add, also for health. The interest of Mr. Holden's Paper consisted in the minute knowledge which his many facts displayed of the subject. He particularly dwelt on the present most imperfect method of dealing with the refuse of towns, and the great evils that resulted from its accumulation near every house. Mr. Henry Ashworth stated that a firm near Bolton had considered it their interest to erect for their workpeople cottages of a superior class, mostly containing three bedrooms, and in other respects commodious and convenient. They were let at a rental of six per cent. on the outlay, and were in great requisition. The beneficial effects upon the social and moral condition of the tenants was undoubted.

The Great Mont Cenis Works.—M. Sommeiller, who is director of the great works connected with the perforation of Mont Cenis, in a letter, states that everything is proceeding satisfactorily. Hitherto the boring has been carried on at the south end, but in January or February vast machines will be set to work on the north side also. Progress is now being made at the rate of about seven feet a day, and this speed will be doubled by February; but it will take at least six years more to accomplish this extraordinary and almost superhuman task.

Auriferous Rocks of Victoria.—The area of the quartz-bearing rocks at Victoria, in Australia, is estimated at 25,000 square miles. The total area of the extent of land at present mined upon in that colony is 561 square miles. Thus 89,920 square acres have produced gold to the amount of £92,787,236, on an average of about £1,032 per acre, and there yet remains upwards of 15,000,000 acres almost everywhere intersected by quartz veins of greater or less thickness, which are as yet intact by the pick of the miner.

Silkworms.—In consequence of the epidemic sometime since amongst silkworms in France, Lombardy, and other places in Europe, large numbers of silkworm eggs have been imported into these places from the Morea, Adrianople, Broussa, Persia, and China. The eggs from China are sent via San Francisco. A consignment of 1,800lbs. of these eggs—which would contain upwards of 860,000,000 in number—was expected at the above-named port a short time since. Silkworm eggs are worth about 13s. per lb. in China, and from two to three guineas per lb. in Europe. France yearly consumes the product of 64,000lbs. of silkworm eggs, and Lombardy the product of 140,000lbs.—*Californian Paper.*

Nature's Salt Works.—The *Silver Age* gives an account of the recent visit of a party of gentlemen to Nature's great salt works in Nevada Territory, who gave fabulous accounts of the grand scale on which Nature works. They estimate the amount of pure salt in sight and fit for sacking at 1,000 tuns, and so strongly are the waters of the pools or springs impregnated, that when the encrustation, usually about three inches thick, is removed, six hours suffices to skim the pool over with a coating of salt. According to the report of those gentlemen, the capacity of these pools is beyond computation—perhaps sufficient to meet not only the present, but all the prospective demands of this territory with an article superior to any imported salt for the reduction of silver ores, on account of the presence of a small portion of alkali. Returning by the way of Esmeralda, they discovered a practicable route from the salt pools to that locality by which a supply can be shipped to that region, when the necessities of the mines shall require it.

Exploit of a Cannon Ball.—The Boston *Courier* publishes a letter of a correspondent, on board the United States' steamer Massachusetts, off Ship Island, October 26th, giving an account of the affair between that vessel and a rebel steamer, in which the following extraordinary exploit of a rifle cannon-ball is chronicled:—During the action I think we hit her four times, and I know she hit us once with a 68 pound rifle shell (that is the way we got the exact size of her rifled gun). The shell entered on our starboard quarter, just above the iron part of the hull; it came through the side angling aft (as we were a little abaft his beam when it struck us), and took the deck in the passage way, between two state rooms, and completely cut off eighteen of the deck planks, and then struck a beam, which canted it up a little, so that it took the steam heating pipes under our dining table, cutting off five of them, and tearing our dining table all to pieces—then went through the state-room bulkhead and ceiling of the ship on the opposite side, and struck one of the outside timbers, and broke every outside plank abreast of it short off, from the spar of the gun deck; it then fell down on to the cabin deck and exploded, knocking four state-rooms into one, breaking all the glasses and crockery ware, shattering the cabin very badly, breaking up the furniture, and setting fire to the ship; but we had three streams of water upon the fire at very short notice, and put it out before it did any damage—keeping up our chase as though nothing had happened.

To Check the Warping of Planks.—The face of the planks should be cut in the direction which lay from east to west as the tree stood. If this be done, the planks will warp much less than in the opposite direction. The strongest side of a piece of timber is that which in its natural position faced the north.

"Photographic Ware Baths."—We find continual allusion and constant praise given in the American journal to a new material for baths. "At present," observes a writer in *Humphrey's Journal*, "probably, the most popular bath is known as the photographic ware, an invention of George Mathiot, an electrotypist, of Washington. The invention grew out of a want in Mr. Mathiot's business, viz., a cheap ware which will hold acid solutions, and consists simply in soaking the vessels of unglazed and porous porcelain in melted wax. Thus Mr. Mathiot killed two birds with one stone, and did a very handsome thing for photography as well as for electrotype. Such ware costs but a trifle, is neat, handy, and durable. Would not paraffin be a useful substitute for the wax? There is no compound known which is so little affected by corrosive matters."

London Association of Foremen Engineers.—At the ordinary monthly meeting of the above Society, held on Saturday last, Mr. Joseph Newton was unanimously re-elected chairman. That gentleman has already held the office for three consecutive years, and was most anxious on this occasion to resign it. His fellow members, however, would not hear of this, nor even nominate any other candidate. Mr. Newton, therefore, with some hesitation, and after witnessing the unanimous vote of the assembled foremen in his favour, consented to hold the post for another year. Mr. William Keyte was appointed Vice-Chairman, and Mr. John Jones, Secretary.

According to the *Times*, one serious defect, of an almost if not quite irremediable character, exists in the construction of iron-cased ships as constructed at present, and is fully exemplified in both the Warrior and Black Prince. This evil is the penetration of water between the teak and armour-plates. This water naturally forces for its exit a passage between the joints of the armour plates, and the opinion at present is that nothing can remedy this under the circumstances of tongued and grooved edged plates hung on a ship's sides by through bolts. Caulking is stated to be useless, and that cannot be wondered at considering the slung weight to be dealt with, and the ship's motion at sea. But the effect of the action of the water in the grooves of the plates and upon the iron bolts can only be expected to be such that in four or five years from the time of commission each ship will require replating.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 1555, 1569, 1572.
Boilers and their Furnaces, &c., 1529, 1533, 1544.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1543.
Ships and Boats, including their fittings, 1557.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 1532, 1533, 1540.
Food and Beverages, including apparatus for preparing food for men and animals, 1562.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1531, 1535, 1543, 1546, 1547, 1548, 1552, 1556, 1563, 1568.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., *None.*
Lighting, Heating, and Ventilating, 1559.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1530, 1537, 1551.
Metals, including apparatus for their manufacture, 1549.
Chemistry and Photography, 1553.
Electrical Apparatus, 1539, 1554, 1567.
Warfare, 1538, 1541, 1550, 1564.
Letter-Press Printing, &c., 1561.
Miscellaneous, 1528, 1534, 1536, 1545, 1558, 1561, 1565, 1571, 1573.

1528. J. Summerscales and M. Mason. *Improvements in gas singeing apparatus.* Dated June 14, 1861.

This relates to apparatus for singeing the loose fibre from the surface of textile fabrics, by a mixture of gas and atmospheric air ignited, which operation is performed by passing or travelling the materials or fabrics over, or otherwise in contact with, a series of gas jets, the gas and air being forced through the burners by a fan, or drawn through by exhausting means. *Patent completed.*

1529. J. Leeming. *Improvements applicable to steam-boilers, furnaces, and flues.* Dated June 14, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

1530. A. P. Johnson. *Certain new and useful improvements in machinery for sewing cloth or other material.* Dated June 14, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1531. P. Langlade. *Improvements in the manufacture of tapestry and other weavings.* Dated June 14, 1861.

Here the patentee employs a loom composed of two beams or rollers between which the warp is distended. Each roller is furnished with a ratchet wheel, into the teeth of which a click or pawl enters, by means of which the beams are prevented from turning in such manner as to allow the warp to become slack. There is much detail which we cannot produce here. *Patent completed.*

1532. T. W. Wedlake. *Improvements in hay-making machines.* Dated June 14, 1861.

This invention consists, 1, in means of causing the drum or frame carrying the forks to rotate in a reverse direction when required to that in which they are ordinarily driven, and in driving the drum by bevel gear, substantially as hereafter explained. The patentee effects this by fixing on the axle of the bearing wheels a bevelled tooth wheel, and by placing upon a shaft, carrying on one end a bevelled toothed pinion, two other bevelled toothed pinions, capable of being moved upon their shaft, so as to bring one or other in gear with the bevelled wheel on the axle of the bearing wheels. The pinion upon the end of the movable pinions' shaft gears into a bevelled wheel upon the shaft or axle of the drum or frame carrying the rakes or forks. The invention consists, 2, in means of raising and lowering the drum or frame carrying the rakes or forks farther from or nearer to the ground. This is effected by connecting the box or frame, which carries the axle of the skeleton drum or frame carrying the rakes or forks, by arms, which are curved and attached to the lower part of the box at one end and to the shafts at the other, and the other arm straight connected to the upper part of the box at one end and at the other end to a box hollowed out and formed with a rack on the inside, and a ratchet or detent on its upper edge, a pinion on a rod passing through the shafts, works inside the box, and gears into the rack. *Patent completed.*

1533. G. Leach. *Improvements in implements for tilling and cultivating the soil, and in boilers for supplying steam to engines for driving the same, which latter improvements are applicable to boilers generally, and specially to boilers of traction engines.* Dated June 14, 1861.

This invention consists, first, in mounting upon a shaft and at an incline, plain or toothed discs, the teeth being formed in a piece with the disc, or made separate therefrom, and fixed thereto. Rotary motion is communicated to the shaft, and, consequently, to the discs, which cut or break up the soil, pulverize it, and turn it over. The patentee denominates this improved implement the "Steam Mole." Similar effects may be produced by mounting toothed discs at right angles upon a shaft, and while the same are rotating upon the shaft, lateral oscillating motion is given to the shaft and discs, equal to the distance the discs are set asunder, by which means a breadth of land may be cut up or cultivated equal to the distance between the extremity of the traverse of the two endmost discs upon the shaft. By having a drum, and mounting or bolting upon the periphery thereof single teeth or segments of more than one, two, or any other number of teeth, such teeth may be made of any desired shape or form best adapted to the soil to be operated upon. The improvements in boilers consist in the employment of series of upright water tubes, let into cases at top and bottom, those at bottom forming water spaces and at top water and steam spaces opening into a steam dome. The fire-place is surrounded by the tubes; between every or some of the series of tubes are placed baffle plates of fire brick or iron. These baffle plates are pierced with holes either circular or elongated, and through these holes the gaseous products and heat pass. Against the baffle plates duplicate plates are fixed, also pierced with holes. The duplicate baffle plates are made movable, so that the apertures may be slidden opposite, or so as to cover any required area of those in the main or fixed baffle plates. By this means, and by arranging the series of holes in each baffle plate so as to suit the intensity of the fire or the velocity of the current or draft, the heat is caused to act upon any portion of the tubes or to flow in any required direction between one series of baffle plates and another, either in a zig-zag or straight direction, in passing from the fire to the chimney. *Patent completed.*

1534. H. J. Kennard. *Improvements in the means of excavating sand and gravel under water.* Dated June 15, 1861.

Here the sand and gravel are drawn into a specially constructed apparatus by means of suction. *Patent completed.*

1535. R. W. Pitfield. *Certain improvements in self-acting mules for spinning cotton and other fibrous substances.* Dated June 15, 1861.

This consists, 1, in the application of a wheel or disc to the copping faller shaft, over which passes a strap, chain, band, or clip, attached at one end to a spring, the other being connected to a lever having an inclined plane at its opposite end. This is so arranged that, when the faliers are about to rise, the movement of the carriage, and the inclined plane levers coming into contact with a stud or bowl causes the strap to tighten, and break the rotation of the disc or pulley, allowing the fallers to rise at any certain speed required. 2. In the application of the "jack in the box" differential motion to the throwing in and out of gear the scroll governing the running in of the spindle carriage, by means of a sliding rod acting upon the break of the differential motion. *Patent completed.*

1536. T. Knowles, P. Alfred and J. Haworth. *Improvements in machinery or apparatus for raising serrated surfaces on rollers.* Dated June 15, 1861.

This relates especially to the rollers of temples used in weaving fabrics, and consists of a duplex machine with two tools, one at the back and the other at the front, the faces of such tools having surfaces made to correspond with the design or peculiar form of the serrated surface required on the rollers; the roller and tools being placed in the machine, a revolving motion is given to both the tools and the roller, and as they come in contact the rollers receive the impression from the tools. *Patent abandoned.*

1537. S. Barnwell. *An improvement or improvements in the manufacture of upholsterer's fringes.* Dated June 15, 1861.

This consists in manufacturing such fringes from chenille, either plain and by itself, or variegated or mixed, or powdered with buttons or drops of plain silk, or trimmed with bullion tips and hangers. *Patent abandoned.*

1538. S. Grant. *Improvements in breech-loading fire-arms and fowling-pieces.* Dated June 15, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1539. F. Potts. *Certain improvements in the manufacture of metallic posts for supporting telegraph wires, and which said improvements are also applicable for other purposes.* Dated June 15, 1861.

These posts are made of sheet iron of a taper form, and of any desired shape in their transverse section. *Patent completed.*

1540. W. Smith. *Improvements in machinery for giving motion to ploughs, cultivators, and other agricultural implements.* Dated June 15, 1861.

Here two drums or cylinders are used, and are placed on the same shaft or axis, in such manner that one at a time only of the drums or cylinders revolves on or with such shaft or axis. These drums or cylinders are as heretofore suitable for winding and unwinding the wire ropes to which the agricultural implements are attached. The shaft or axis receives motion (or the drums or cylinders thereon) from a steam engine by an endless chain which gears into a chain wheel on the shaft or axis on which the drums or cylinders are placed. The steam engine gives motion to a smaller chain wheel with which the endless chain also gears. It is preferred, that the chain wheel (which is on the same shaft or axis as the drums or cylinders) should be between the two drums or cylinders; but this is not essential. The drums or cylinders are each capable of being held by clutches, one part being affixed to the nave of the cylinder or drum, and the other part capable of sliding on the shaft or axis; and there is a wedge or filling piece introduced when the clutches of one of the cylinders or drums are engaged, so as to keep them engaged to the plough or other agricultural implement attached till the rope comes to the end of a bout, when the wedge or filling piece is to be removed; the steam engine is then also stopped, when, by reason of there being inclined or screw threaded feathers on the axis or shaft, or on the nave of the chain wheel thereon, and in the sliding part of the clutch, such part of the clutch will be caused to slide along the shaft or axis, and to disengage itself from the other part of the clutch which is on the drum or cylinder by reason of the tension on the wire rope, causing such drum or cylinder to make a partial back turn. It should be stated that both of the cylinders or drums are similarly actuated, so that the description above given to one applies to both. *Patent abandoned.*

1541. T. Page. *Means and apparatus for facilitating the working and discharge of ordnance placed below the water level.* Dated June 15, 1861.

The patentee claims the use and application of a chamber, and maintaining a pressure of air thereon, for the purposes of firing and discharging projectiles below the water level. *Patent completed.*

1542. H. C. Simpson. *A new or improved vehicle or car.* Dated June 17, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1543. T. Gray. *A new method of bleaching coloured rags and vegetable fibres.* Dated June 17, 1861.

The patentee claims the steeping and immersion of the substances to be bleached in a solution of muriatic acid and water, previously to their being submitted to the action of bleaching liquor. *Patent Completed.*

1544. S. R. Smyth. *A new or improved steam boiler.* Dated June 17, 1861.

This consists in constructing boilers with the upper and lower surfaces so curved as to form an arch, the said surfaces being plain or corrugated longitudinally, as may be required, and provided with flange projections at the sides or ends for taking into the brickwork or otherwise. At the upper portion of the said boiler an arched or horse-shoe shaped steam-chest is to be placed, and secured centrally and longitudinally, and furnished with suitable openings, communicating with the interior of the boiler for the flow or passage of the steam. By this arrangement the flues may be carried above and below the boiler, so as to extend the heating surface, and permit the exposure of any portion of the boiler to the external air. *Patent abandoned.*

1545. D. B. White. *Improvements in plummets and gauges for indicating the depth and the height or level of liquids.* Dated June 17, 1861.

This invention is more particularly intended to indicate on ship-board the height or depth of water that may have leaked into or otherwise entered the hold, but it is applicable to indicating the depth and the height or level of liquids generally. According to one arrangement, the invention consists in the employment of a galvanic battery, a wire from one pole of which leads to a needle, or series of needles or indicators, while communication is established to complete the electric circuit by means of a float, or, in the case of salt water and other good conducting liquids, by the water itself rising and coming in contact with one or other of a set of metal plates placed one over another, and each having connected to it a separate wire leading to the indicating apparatus. The plates being at different levels the indicating apparatus shews which plate is in communication, and consequently the height of the liquid. According to another arrangement, the patentee employs an annular piston working between a cylinder and an internal tube containing the wires which lead to the metal plates before mentioned. These plates are all connected with one pole of the battery, and a wire attached with a tongue to the piston and which rises and falls therewith, is connected to the other pole. As the column of water presses on the piston, (the pressure being proportionately counteracted by a spring or springs), it moves the tongue with the wire to the one or other of the metal plates, and the needles or indicators show which plate is in communication, as in the former arrangement. To adapt a plummet to this arrangement, he appends a brass bell to a line wire which passes through the internal tube before named. Two wires from different poles of the battery are carried one to the cup of the bell and the other to the clapper, communication between them being prevented. When the plummet reaches the ground the bell falls on one side, and the clapper coming in contact with the cup completes the electric circuit and causes an indication to be made. He sometimes hangs a plummet of this description over the stern or other part of a vessel and attaches it to a windlass which is in communication with a battery. *Patent completed.*

1546. J. Lewis. *Improved materials for cutting and boring wood and other substances.* Dated June 17, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1547. T. Mellodew, C. W. Kesselmeyer, and J. M. Worrall. *Improvements in dyeing and printing velvets, velveteens, and other fabrics with floated threads.* Dated June 17, 1861.

The patentee claims, 1, the application of the solution of iron or other mordaunt by the process of padding, to the back only of velvets, velveteens, cords, or other such fabrics as aforesaid. 2. The use, for the above-named fabrics, of cotton, or other such material as aforesaid, which is prepared only for dyeing by the application of a mordaunt. *Patent completed.*

1548. T. Routledge. *Improvements in the manufacture of paper.* Dated June 17, 1861.

This consists in the preparation of half-stuff (paper pulp) and paper from Esparto or Spanish grass (comprising spartum ligeum, stipa terracissima, dis or alfa), the same being applicable to straw and other raw fibrous substances. The general details of the process are the same as specified in a patent (No. 274.) dated 2nd February, 1860, the improvement consisting in that portion which relates to the preparation of the leys employed in boiling Esparto or other raw fibres, and in order to preclude the presence of lime in the caustic state, or even too much causticity in the leys. *Patent completed.*

1549. W. Clark. *Improvements in the manufacture of letters, designs, and other articles of mica variously coloured or metallised.* Dated June 17, 1861. (A communication.)

The patentee claims the new application of mica, as described, superposed and gummed in sheets or pieces of different colours or shades in the manufacture of letters, signs, and other devices, for ornamental and useful purposes. *Patent completed.*

1550. W. Clark. *Improvements in batteries and in breech-loading ordnance and projectiles for the same.* (A communication.) Dated June 17, 1861.

This consists, 1, of a portable battery formed of plates of iron, connected together by bars and bolts counter-sunk in ribs on the plates. The structure is made of dimensions suitable for holding several persons, and is provided with a shot-proof roofing, and has also port holes in the sides for the muzzles of the guns. The whole battery may be made to run on lines of rails by means of any suitable dynamic engine. 2. In the construction of a breech-loading cannon adapted for these portable batteries, either for land or sea service. The breech-piece is formed of a plate engaging in a mortise made in the back end of the gun; when this plate is raised it leaves an opening for the free passage of the shot or charge, and when lowered it again closes the breech as before. This breech-piece is handled by levers or other gearing, it may also carry a pin or striker for igniting the charge. The 3rd part relates to improved projectiles to be used with the foregoing breech-loading ordnance, which are of a cylindro-conical form; the conical part carries a screw thread which engages in the grooves of the gun; the head of the cone is formed of a steel cap for penetrating objects, while the cylindrical part is hollow, and varies in diameter, in order to prevent windage. *Patent abandoned.*

1551. J. Perry. *Improvements in washing machines.* Dated June 17, 1861.

This consists, essentially, in disposing and using a screw piece as an agitator to act on the materials being washed, and in forming the ribs or friction surfaces disposed on the interior of washing machines of screwed or spiral form. *Patent completed.*

1552. W. and J. Todd. *Certain improvements in power looms for weaving.* Dated June 17, 1861.

This relates to an improved picking motion for looms, wherein the arrangement of mechanism employed shall cause a direct action to be given to the picking apparatus by a peculiar arrangement of studs, plates, or fingers, so formed and adjusted in their respective levers, that by their being brought into contact from two opposite centres, a sharp, clear, or slightly-yielding motion shall be transmitted to the picking stick without any deterioratory wear to the picking apparatus employed. *Patent completed.*

1553. A. R. le M. de Normandy. *Improvements in refrigerating the fresh water produced by condensing steam.* Dated June 18, 1861.

This consists in arranging the apparatus so that the condensing tubes, instead of occupying the whole length of the cylinder or vessel used for condensation (as in the apparatus known as Normandy's marine aerated fresh water apparatus), occupy only a certain portion of the upper part thereof, and the lower part is provided with a tube or tubes, or suitable refrigerating apparatus, so con, structed and placed that the water condensed in the upper portion of the cylinder is refrigerated in the passing through the lower part of the condenser. *Patent completed.*

1554. J. BANKS. *Improvements in electro-magnetic telegraph apparatus or marking instruments.* Dated June 18, 1861.

This consists in certain novel arrangements of electro-magnetic apparatus, by which the needle or style used for providing certain marks, indentations, indications, or signals in the shape of dots and lines upon ribbons or slips of paper is made to operate direct and rapidly with the minimum of power. *Patent abandoned.*

1555. J. MILLER. *Improvements in rotary engines.* Dated June 18, 1861.

This consists in the combination of a barrel or roller with a sliding piston working in a cylinder or steam case, such barrel or roller being fixed concentric in the cylinder, and the piston sliding through the barrel or roller, and covering and opening, at the required intervals, the ports, which are formed in one or both of the cylinders covers in such a manner as to dispense with the use of slide valves. Also the form of the cylinder in the cross section is slightly varied from the circular, so as to admit of the piston fitting the interior thereof in every part of its revolution. The diameter of the barrel or roller is about two thirds of that of the cylinder, and the centre of the axis thereof is so placed as to admit of the air barrel or roller touching the interior of the cylinder, the parts being formed on each side of the hole in the cylinder cover or covers through which the said axis is passed. *Patent completed.*

1556. P. ZIFFER. *Certain improvements in carding engines for carding cotton and other fibrous substances.* Dated June 18, 1861.

This consists in the application and use of a semi-circular grid or cage beneath the main cylinder and other cylinders in carding engines, for the purpose of retaining the fibre or loose filaments of cotton or other fibrous substances, and allowing dust and other extraneous matter to fall through. *Patent completed.*

1557. R. WALKER. *Improvements in propelling vessels.* Dated June 18, 1861.

In one modification of this invention the propelling instrument consists of a blade which, when at rest, lies horizontally, and which is fixed by its front end at right angles to a vertical rod arranged at the stern of the vessel, for example, and made to reciprocate vertically. The blade is constructed so as to possess an elastic flexibility, and when it is moved downwards, its outer back end is bent upwards, its surface being inclined in such a way as with the downward motion to propel the vessel forward. When the blade is moved upwards, it becomes bent in the opposite direction, so as to be inclined downwards towards its outer back end, and so that it still propels the vessel forward. There may be two or more such propelling blades on the same reciprocating rod, or on separate rods, and they may be arranged to work at the sides or other part or parts of the vessel. *Patent completed.*

1558. R. PELL. *Improvements in obtaining motive power.* Dated June 18, 1861.

This consists in a method of obtaining motive power by means of compressed air acting upon water. *Patent abandoned.*

1559. W. B. TAYLOR. *Improvements in heating by means of lamps, and in imparting heat to vessels and their contents, also applicable to cooking and to other purposes.* Dated June 18, 1861.

The mode or method of employing or utilizing the heat of flame from lamps in heating the fluid contents of vessels is by forming them with an internal flue or tube of any suitable form, and by removing the glass chimney ordinarily used for insuring perfect combustion in the production of light, and placing the vessel as described upon or over the lamp in such a position as the vertical flue or tube of the vessel will form an equivalent for the glass chimney or flue before used. *Patent abandoned.*

1560. W. FLEMING. *Improvements in machinery or apparatus for manufacturing snuff.* Dated June 18, 1861.

This consists in a method of constructing snuff mills, whereby the rollers of such mills do not heat during the working, and whereby they are always properly lubricated and kept up to the surface of the grooved cylinder. *Patent completed.*

1561. S. SHARP. *Certain improvements in printing machines, and in apparatus for taking off and delivering the sheets when printed, and which said apparatus is applicable to the printing machines now in use.* Dated June 18, 1861.

These improvements apply to printing machines where rapidity of action is required, and consist in what the inventor terms a fast machine, constructed of a number of small cylinders, deriving their motion from a large cylinder, each small cylinder having its own laying-on board, so that the process is continuous, namely, that of laying-on the paper, and its accompanying roller taking around over the form, and delivering it. The invention also consists in a method of printing either on one or both sides of a continuous roll of paper. The invention further consists in a self-acting inking apparatus; also in a particular construction of taking-off apparatus. *Patent abandoned.*

1562. A. W. GIBSON. *Improvements in mills for the manufacture of barley and rice.* Dated June 18, 1861.

This invention has reference to a patent dated 28th April, 1854 (No. 962), and comprises much detail which we cannot quote here. *Patent abandoned.*

1563. J. DUNN. *Improvements in machinery or apparatus for slubbing, roving, spinning, twisting, and doubling cotton and other fibrous substances.* Dated June 18, 1861.

This relates to certain modifications of the apparatus for which provisional protection was granted to the present patentee the 6th April, 1861 (No. 846), and consists in the introduction of drawing rollers, carried by a suitable frame, to the inside of the flyer, which is mounted horizontally, the frame being suspended loosely from each internal extremity of the flyer. A full bobbin of the material to be operated upon is placed upon a spindle, also inside the flyer, from which bobbin the material is unwound or drawn off by the action of the drawing rollers, to which the requisite motion is imparted from the neck of the flyer by an endless screw and worm wheel. From these rollers the material passes through the tubular neck of the flyer, and along the side thereof, which is either hollowed, or channelled, or solid, and furnished with guide eyes for that purpose, finally issuing through another tubular neck on the opposite ends of the flyer, a double twist at each revolution of the flyer being consequently imparted to the material. *Patent completed.*

1564. J. A. LIMBERT. *Improvements in mounting and fitting ships' guns and other ordnance.* Dated June 18, 1861.

Here the inventor mounts ships' guns on a pivot, or cross bearing placed above the gun, from which it is suspended and free to oscillate in the direction of its length. From the bearing depends four rods, two on each side of the gun, each pair spreading, the one towards the muzzle and the other towards the breech of the gun. The lower ends of the depending rods carry sliding pieces fitted to arcs fixed to or formed on the side of the gun, such arcs being described from a centre more or less below the gun. The suspending bearing is supported from the lower part of the gun carriage by two wrought-iron uprights, and such stays as are necessary. These uprights are in or about the same vertical plane as the suspending rods, and have surfaces of abutment and contact for the sliding pieces, carried by such rods and sliding in the arcs. *Patent abandoned.*

1565. W. E. NEWTON. *Improved apparatus for transmitting motion.* (A communication.) Dated June 18, 1861.

This consists in the use of disc wheels which transmit motion by frictional contact upon their sides. The frictional surfaces are mounted on an intermediate shaft, and are pressed together by a coiled spring, so as to insure contact only upon the line of centres of any two wheels. The edges or peripheries of the driving and driven wheels are placed between the discs, and the pressure required to produce the necessary adhesion is applied by the spring upon the opposite surfaces. The desired result is obtained without producing much, if any, pressure upon the journals upon which they revolve. The discs are fixed upon a kind of universal joint and the side pressure will, therefore, follow up the wear and inequalities of surface without interfering with the position of the centres of rotation. *Patent completed.*

1566. M. MC KAY. *An improvement or improvements in the manufacture of cements or adhesive solutions for joining or connecting together surfaces or articles of leather, wood, paper, or other similar materials.* Dated June 18, 1861.

Here the patentee takes the bisulphuret of carbon, or its chemical constituents or equivalent, in which he dissolves pure gutta percha, leaving the vessel in which he is working open to allow the bisulphuret of carbon to take up a sufficient quantity of oxygen. *Patent completed.*

1567. W. E. NEWTON. *Improvements in electro-magnetic engines.* (A communication.) Dated June 18, 1861.

This relates, mainly, to an improvement on what is known as the metallic wheel or plate of magneto electro engines, whereby the currents which are induced alternately in opposite directions are taken off and caused to return continuously in the same direction. The second part, which also relates to an improvement in magneto-electric engines, consists in connecting the cores of a series of spools or coils, arranged in a circle, by a ring of soft malleable cast iron or wrought iron, or any equivalent substance which possesses the property of readily taking and discharging induced magnetism, whether the circle of spools or coils with their cores so connected be used in connection with rotating magnets, or the circle of spools be made to rotate and used in connection with stationary magnets, or whether the magnets and the circle of spools or coils be both made to rotate. *Patent completed.*

1568. T. WEBB and J. CRAIG. *Improvements in machinery or apparatus for spinning, doubling, and winding cotton and other fibrous materials.* Dated June 18, 1861.

This relates to those spindles and flyers which are provided with top bearings, and consists in adapting such bearings to the spindle direct, instead of to the flyer, and the inventors form a passage for the yarn by boring the spindle vertically from the top, and with an outlet on one or both sides. *Patent abandoned.*

1569. J. E. KIRBY. *Improvements in steam engines and machinery for giving motion to agricultural implements and other machines.* Dated June 18, 1861.

We cannot give space to the voluminous details of this invention. *Patent abandoned.*

1570. J. DIXON. *Improvements in water-closets and cocks, used therewith.* Dated June 18, 1861.

This consists in a method of simplifying the construction of water-closets, by dispensing with any connections to cisterns, except by a pipe, which is to be brought either from a cistern or from a main pipe, without the necessity of wires, cranks, service boxes, valves, &c. *Patent completed.*

1571. T. T. JOPLING. *Improvements in machinery for the manufacture of bolts, spikes, screw-blanks, and rivets.* Dated June 18, 1861.

Here the dies are received into the face of a disc, which is mounted on a fixed axis, the disc receiving a step by step movement at intervals, a distance equal to that between the centres of the dies. On the periphery of the disc are ratchet teeth, one for each die carried by the disc. On the axis in which the disc is carried is an arm which moves freely on such axis and in front of the disc. This arm carries a driver, which, when the arm is moved, takes into the ratchet teeth, and gives motion to the disc; and such arm also carries a cutting edge, which, together with a stationary cutter, causes the bar or rod—when its end has been introduced into a die in the disc—to be cut. There is much other detail which we cannot give space to here. *Patent completed.*

1572. J. LOUCH. *Improvements in furnaces and condensers of steam-engines, part of such improvements being applicable to other purposes.* Dated June 19, 1861.

Here the great bars of boiler or other furnaces are formed of two or more plates or bars of iron, melted or bolted together, leaving suitable air spaces between each of such plates or bars. Tubes of metal, or perforated fire-brick, are inserted in the inside of furnace doors, through which the air in passing becomes heated. The improvement in condensers consists in certain arrangements, by means of which a thin film, or several small jets of water are made to run over and upon the inner or outer surfaces of the tubes, or other condensing surfaces, while a current of air is at the same time allowed to pass through, over, or amongst the said tubes or other condensing surfaces. *Patent abandoned.*

1573. C. E. BUTLER. *Improvement or improvements in the manufacture of riddles or sieves.* Dated June 19, 1861.

Here the inventor places the wire or other bottom of the sieve over a hoop or hinge a little smaller than the outer rim constituting the body of the riddle or sieve. The hoop or lining is rounded or curved inwards on its upper edge, so that the bottom of the riddle or sieve may be stretched over it without danger of being cut or torn. The outer rim or body of the sieve is forced upon the said hoop or lining, and pressing the edge of the bottom over the said hoop or lining, tightens the bottom upon the hoop or lining. The edge of the bottom is then turned upwards, over the lower edge of the hoop or lining, and a small additional lining of iron or sheet metal is put over the edge of the body of the riddle or sieve, and the hoop or lining, thereby covering the said edges, as well as the turned in edge of wire or other bottom. By means of rivets the last-named lining is fixed to the hoop or lining on which the bottom is stretched, as well as to the rim constituting the body of the riddle or sieve, and all the parts are thereby secured together. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 26, 1861.

2120. R. W. Jones, Glenbrook Baths and Hotel, Cork. Improvements in heating and ventilating, especially applicable to Turkish baths.

Dated Sept. 12, 1861.

2267. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. An improved combination of machinery for the production of Valenciennes, Chantilly, Brussels, and other similar laces. (A communication.)

Dated Sept. 14, 1861.

2293. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. An improved apparatus for the conveyance of medicinal substances into various parts of the human body. (A communication.)

Dated Sept. 21, 1861.

2362. C. Board, Bristol, cabinet maker. Improvements in veneering presses.

Dated Dec. 4, 1861.

3042. R. Kennedy and J. Armstrong, Lisburn, Ireland. An improved arrangement of driving gear.

Dated Dec. 5, 1861.

3047. A. T. Carr, Carlisle-street, Soho, gentleman. The addition to horses' shoes of certain material to prevent slipping.

3050. J. Wilson, Glasgow, picture frame maker. Improvements in frames used for displaying trade show cards, pictures, or other similar devices.

Dated Dec. 6, 1861.

3056. E. D. S. T. F. Wells and G. A. Phillips, Norfolk, Massachusetts. An improved apparatus for holding and placing percussion caps on fire-arms.

Dated Dec. 10, 1861.

3092. W. F. Stanley, mathematical instrument maker, 3 Great Turnstile, Holborn. The use of aluminium for the construction of mathematical instruments used for geometrical drawing, surveying, and nautical purposes, and improvements connected therewith.

Dated Dec. 11, 1861.

3105. J. Schloss, Cannon-street, City, merchant. An improvement in forming the leaves of albums and books for containing photographic portraits and views. (A communication.)

3107. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in decorating or printing upon china, porcelain, earthen, and other like wares. (A communication.)

3109. J. Potter, Leeds, wire fencing manufacturer. An improved mode of jointing or connecting telegraph wires, which is also applicable to jointing or connecting signal wires, fencing wires, and other wires or rods.

Dated Dec. 12, 1861.

3111. R. Searle, Woodford Wells, Essex, gentleman. Improvements in the treatment, preparation, and combination of metals used for sheathing ships and marine erections, also for roofing buildings and other purposes.

3114. W. W. Godfrey, 52 Whiskin-street, Clerkenwell, gold chain manufacturer and goldsmith. An improved fastener or protector for Albert guards.

3115. W. E. Wiley, 34 Great Hampton-street, Birmingham, gold pen and pencil-case manufacturer. An improvement or improvements in pencil-cases and holders for crayons and other solid writing or marking materials, which improvement or improvements may also be applied to crotchet needle holders.

3116. R. Mushet, Coleford, metallurgist. An improvement or improvements in the manufacture of iron and puddled steel.

3117. W. S. Longridge, Alderwasley Iron Works, Derby, engineer. Improvements in railway wheels and tyres.

3118. A. Tonnar, Eupen, Rhenish Prussia, brewer. Improvements in the method of, and apparatus for, drying and cleansing malt, as well as any other species of grain and seed intended for brewing, distilling, and agricultural purposes.

3119. J. W. Scott, Worcester, button manufacturer. Improvements in wads for fire-arms.

3120. J. D. Jobin, South-island-place, Clapham-r engineer. Improvements in locomotive engines, which improvements are also applicable to marine and stationary engines.

3121. H. Bailey, Trump-street, Cheapside. An improved button or stud.

Dated Dec. 13, 1861.

3122. R. Ashworth and G. Shepherd, manufacturers, J. Cormack, mechanic, and J. Dearden, overlooker, Stacksteads, Lancaster. Improvements in looms for weaving.

3124. W. Bell, Leamington, manufacturer. Improvements in kitcheners or cooking ranges.

3125. F. Brampton, Birmingham, manufacturer. An improvement or improvements in the manufacture of the middle joints of measuring rules.

3126. H. J. Olding, Smith-square, Westminster, engineer. Improvements in the mode of, and apparatus for, feeding steam boilers, also in apparatus for supplying fluids, for other purposes, and in apparatus for raising fluids.

3127. E. C. B. de Beaulieu, Avallon, Yonne, France. Improvements in the manufacture of spirituous liquors, and in apparatus employed therein.

3128. G. Bird, Glasgow, manufacturing chemist. An improved grease for lubricating frictional surfaces.

3130. T. Walker, Birmingham, engineer. Improvements in means or apparatus for indicating the speed of vessels, and for taking soundings.

3135 A. V. Newton, 66 Chancery-lane, mechanical draughtsman. An improved arrangement of fire escape. (A communication.)

3136. J. Hetherington, Manchester, machine maker, T. Webb, Smallwood Manor, Uttoxeter, Stafford, Esquire, and J. Craig, Tutbury, cotton spinner. Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.

3137. H. Appleby, 4 Tavistock-place, Plumstead-common, gentleman, and H. Harrison, Grand Junction Works, Northampton, engineer. Improvements in machinery for boring wood and other materials used in the manufacture of brooms and brushes.

3138. T. K. Adkins, Wallingford, Berks, and J. Bonthron, 106 Regent-street. Improvements in the manufacture of starch and in apparatus employed therein.

3139. J. Kelly, Brook Lodge, Roscommon, C.E. Improvements in the treatment of milk for the manufacture of butter, and in apparatus for the same.

3141. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in blowers or apparatuses for superheating steam and other gases, and for projecting them combined with atmospheric air upon ignited combustible matter. (A communication.)

Dated Dec. 14, 1861.

3143. J. E. Duyck, Tutsham Mills, West Farleigh, Kent, gentleman. Improvements in the expression of oil from cake and seeds, and in apparatuses employed therein.

3146. W. R. Rogers, Gray's-inn-road, builder. An improved mode of constructing dovetail joints.

3147. W. E. Debenham, The Terrace, Kensington-gardens-square. An improved plate holder for photographic purposes.

3148. W. Husband, Hayle, Cornwall. An improved water safety valve.

3149. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in railway rolling stock. (A communication.)

Dated Dec. 16, 1861.

3151. J. Willis, jun., Newcastle-on-Tyne, miller. Improvements in the preparation of materials applicable to the manufacture of paper.

3153. G. Davies, 1 Serle-street, Lincoln's-inn-fields, C.E. Improvements in the manufacture of textile materials. (A communication.)

3154. W. Bartram and W. S. Harwood, Sheffield, powder flask manufacturers. An improved apparatus for filling and ramming cartridges for breech-loading and other fire-arms.

3155 D. Chalmers, Glasgow, machinist. Improvements in looms for weaving, and in the manufacture of cloth therefrom.

3157. W. G. Laws, Tynemouth, C.E. Improvements in railway point signals.

Dated Dec. 17, 1861.

3161. J. B. Bunney and T. Wright, Birmingham, electro-platers. Improvements in ornamenting metallic and non-metallic bedsteads and other articles made principally of metallic rods or tubes.

3162. R. Shaw, Marple, Chester, mechanic. Certain improvements in carding engines.

3164. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved hoisting apparatus. (A communication.)

Dated Dec. 18, 1861.

3166. R. Scott, 29 Great Portland-street, gun maker. An improved method of rifling or grooving the barrels of fire-arms and ordnance.

3168. J. Perrin, Hyde, Chester, engineer. An improved equilibrium valve.

3170. W. Dicey, Waltham Abbey, Essex. Improvements in submarine electric telegraph cables.

3172. M. Hauff, Tottenham-street, Tottenham-court-road, fancy box maker. Improvements in the manufacture of boxes and cases.

3171. J. Thiébaut, Mile-end. Improvements in the ornamentation of textile fabrics.

3176. E. Pace, Queen-street, City, manufacturer. An improved lath for Venetian blinds.

3178. J. Bannehr, High-street, Exeter. Improvements in apparatus for desiccating grain, seeds, and other articles.

Dated Dec. 19, 1861.

3180. W. Betts, Wharf-road, City-road, patent capsule manufacturer. Improvements in the manufacture of coverings for the ends of cigars.

3182. W. Tate, Horsley-hill, near South Shields, Durham. Improvements in armour, and in making and applying the same for protecting wood and iron ships of war and batteries.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

3251. M. Henry, 84, Fleet-street. Improvements in fire arms, and in adapting bayonets or cutting or piercing weapons thereto. (A communication.) Dated Dec. 28, 1861.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2108. S. Elson. Heating the feed water of steam boilers.

2120. R. W. Jones. Heating and ventilating.

2123. G. Nye. Administering injection.

2124. A. Lechene and G. Nathan. Ladies' collars and cuffs.

2125. J. L. Field. Armour plates.

2126. F. Tolhausen. Artificial fur. (A communication.)

2130 H. Attwood. Cleansing and feeding boilers.

2135. J. C. C. Azémar. Drum.

2139. J. M. Hart and R. Lavender. Handles or knobs.

2140. A. Granger. Wearing apparel.

2142. B. Browne. Concentrating ores. (A communication.)

2151. V. A. Janvier. Fastenings for gloves.

2153. A. V. Newton. Cleaning grain. (A communication.)

2155. L. D. Owen. Ploughs. (A communication.)

2159. A. Jaille. Manufacture of manure.

2161. H. W. Spencer. Animal oils.

2164. H. Lecauley. Succouring persons interred before life is extinct. (A communication.)

2172. T. M. Jones. Articles for roasting.

2174. C. Pemberton. Signals.

2177. J. Jones. Clasps or fastenings.

2179. J. M. Dunlop. Cleansing cotton seeds.

2187. J. Hall. Extinguishing fires.

2188. J. Watson. Furnaces.

2189. E. Alcan. Carding and combing wool. (A communication.)

2195. E. Suckow and E. Habel. Producing a strong blast or current of air.

2201. W. E. Newton. Self-acting brakes. (A communication.)

2211. P. Efferts. Bricks, tiles, and drain-pipes.

2213. F. Bennett. Coating pipes.

2234. M. Henry. Signalling on railways. (A communication.)

2240. G. Norris. Manufacture of soap.

2214. G. H. Birkbeck. Saddles. (A communication.)

2267. M. A. F. Mennons. Production of lace. (A communication.)

2284. W. E. Newton. Guns. (A communication.)

2332. J. Gurman. Hanging window sashes.

2421. G. J. Ganier and E. E. Collet. Envelopes.

2464. W. T. Henley. Magnetic and electric telegraph.

2576. A. V. Newton. Harvesters. (A communication.)

2607. J. Webster. Manufacturing oxygen gas.

2663. J. McCall and B. G. Sloper. Preservation of articles of food.

2776. C. F. Hayes. Generating steam.

2778. R. A. Brooman. Steam generators. (A communication.)

2920. J. H. Johnson. Treatment of zinc ores. (A communication.)

2973. G. Bottomley. Fibrous waste or vegetable substances.

3013. W. H. Balmain. Potash and salts of potash.

3052. J. Cochrane. Gas-meters.

3098. W. E. Newton. Knapsacks. (A communication.)

3124. W. Bell. Kitcheners or cooking ranges.

3127. E. C. B. de Beaulieu. Spirituous liquors.

3143. J. E. Duyck. Expression of oil from cake and seeds.

3153. G. Davies. Manufacture of textile materials. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

LIST OF SEALED PATENTS.

Sealed Jan. 3, 1862.

1720. H. Schutt.
1723. J. Ridsdale.
1727. E. R. Handcock.
1728. G. Tutill.
1732. T. Cobley.
1734. T. Cobley.
1740. J. Keats and G. E. Keats.
1750. J. Farron.
1751. T. G. Messenger.
1781. W. Clark.
1916. J. Lewis.
2768. G. Horton.

Dated Jan. 7, 1862.

1733. T. T. Macneill.
1739. W. C. Parkinson.
1751. J. R. Cotter.
1755. H. Ashwell.
1758. J. Adams.
1766. F. Tolhausen.
1783. E. G. F. de la Provotais.
1815. R. Walker.
1817. R. Mushet.
1853. J. Sidebottom.
1866. M. Klotz.
1875. F. N. Thurel.
2528. T. P. Bennett and J. Collier.
2635. H. Frost.
2723. R. W. Winfield.
2724. R. W. Winfield.
2878. W. E. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

5. J. E. Drouot.
17. J. Harris.
37. F. Clark.
39. J. Howard.
42. W. Corfield.
50. J. H. Johnson.
52. I. Holden & A. Holden.
84. D. E. Hughes.
133. R. Garrett, jun., and J. Kerridge.
2995. S. S. Bateson.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

73. E. Hall.
25. G. W. Muir.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Jan. 4, 1862.

No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No	Pr. s	Pr. d
[illegible]	0	2	1281	0	3	1205	1	4	1309	0	3	1323	0	10	1337	0	9
[illegible]	0	3	1282	0	7	1296	0	11	1310	0	5	1324	0	6	1338	0	3
1268	0	5	1283	0	7	1297	1	4	1311	0	6	1325	0	8	1339	1	4
1269	0	5	1284	0	3	1298	0	10	1312	0	5	1326	0	6	1340	0	3
1270	1	[illegible]	1285	0	3	1299	0	3	1313	0	7	1327	0	5	1341	0	3
1271	0	4	1286	1	4	1300	0	3	1314	1	1	1328	0	8	1342	0	6
1272	0	[illegible]	1287	0	10	1301	0	6	1315	0	3	1329	0	4	1343	0	3
1273	0	8	1288	0	7	1302	0	6	1316	0	3	1330	0	5	1344	0	3
1274	1	8	1289	0	9	1303	0	7	1317	0	3	1331	1	7	1345	0	3
1275	0	8	1290	0	6	1304	4	7	1318	1	6	1332	0	10	1346	0	3
1276	0	5	1291	0	9	1305	0	6	1319	0	5	1333	0	10	...		...
1278	1	4	1292	0	3	1306	0	10	1320	0	5	1334	0	7	...		...
1279	0	6	1293	0	6	1307	0	10	1321	0	3	1335	0	3	...		...
1280	0	4	1294	0	7	1308	0	9	1322	0	4	1336	0	8	...		...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos in Register.	Names and Addresses.	Subjects of Design
Dec. 10,	4422	E. F. D. Walsh, Manchester-street, W. ...	Paper and envelopes combined.
,, 12,	4423	J. Collins, Birmingham	Rein-holder.
,, 14,	4424	S. Powell, Kent-road...	A breast drawer.
,, 16,	4125	Shotts Iron Co., Glasgow..................	Chimney damper
,, 18,	4126	J. White, East Greenwich	Watch protector
,, ,,	4127	A. W. Miles, Brook-st.	Trowsers.
,, 28,	4128	R. Alty and J. Whiteside, Kirkham.........	Reaping machine
PROVISIONAL REGISTRATIONS.			
Nov. 15,	1287	J. Stickland, West Ham, E.	Lubricating cock
,, ,,	1288	C. L. Roberts, St. John-street	Capsulated cigar
,, 19,	1289	C. & H. Stent, Coventry-street, S.W.	Bellows.
,, 25,	1290	W. Chamberlain, Dodbrook	Plough.
Dec. 2,	1291	S. Kennard, Clarence-street, S.	Chemise and drawers combined.
,, 7,	1292	E. Gill, Pembury-grove	Desk.
,, ,,	1293	T. Lupton, Harrogate	Foot iron.
,, 11,	1294	R. Chase, Selsy	Plummer block and journal.
,, 16,	1295	D. Lichtenstadt, Gloucester-terrace, S. ..	Blow-pipe apparatus.
,, ,,	1296	W. Parkinson, Ripton	Washing machine.
,, 18,	1297	J. Willcock, Chancery-lane	Shirt collar.
,, 20,	1298	J. Good, Colchester ...	Lottery spring pull.
,, 26,	1299	J. F. Bland, Capt. 76th Regiment	Field register folio.

PRICES CURRENT OF METALS.

London, Jan. 10, 1862.

		£	s.	d.		£	s.	d.	p. ct
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	6	0	0	nett
Welsh Bars, in Wales	,,	5	6	0	,,	6	7	6	0
Staf. Bars, at the Works ..	,,	5	10	0	,,	7	5	0	2½
,, Hoops	,,	7	10	0	,,	8	0	0	,,
,, Sheets, Singles	,,	9	0	0	,,	9	0	0	,,
,, Nail Rods	,,	6	15	0	,,	0	10	0	,,
,, Boiler Plates	,,	8	0	0	,,	8	10	0	,,
Scotch Pig, M. Nos. Warrants, at Glasgow	,,	2	10	0	,,	2	11	0	nett
Do, No. 1, Good Brands ..	,,	2	13	0	,,	2	18	0	,,
Scotch Bars	,,	7	6	0	,,	7	15	0	,,
Swedish Bars, in London ..	,,	10	10	0	,,	11	0	0	,,
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	,,	0	0	0	2
Tough Cake and Tile......	pr. ton	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Australian	,,	104	0	0	,,	0	0	0	,,
South American	,,	0	0	0	,,	0	0	0	,,
Yellow Metal Sheathing ..	per lb.	0	0	5½	,,	0	0	0	,,
STEEL.									
Swedish Keg..............	pr. ton	16	0	0	,,	0	0	0	2½
,, Faggot	,,	16	0	0	,,	0	0	0	,,
TIN:									
English, Block............	p. cwt.	6	1	0	,,	0	0	0	2½
,, Bar............	,,	6	2	0	,,	0	0	0	,,
Foreign, Banca	,,	6	2	0	,,	6	3	0	nett
,, Straits	,,	6	0	0	,,	0	0	0	,,
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	,,	1	9	0	2
Coke, I C................	,,	1	1	6	,,	1	4	0	,,
LEAD.									
Pig, English..............	pr. ton	19	10	0	,,	20	0	0	2½
,, Spanish	,,	19	0	0	,,	19	10	0	,,
Common Sheet	,,	21	10	0		22	0	0	,,
Tea ,, (Wimshurst's Patent) A special disct...	,,	35	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	0	0	,,	0	0	0	nett
For arrival	,,	18	5	0	,,	18	7	6	,,
ZINC:									
English Sheet	,,	26	0	0	,,	0	0	0	
QUICKSILVER............	pr. btl.	7	0	0	,,	0	0	0	

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers E.C.

Digitized by Google

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 17, 1862.

WHAT INDIA IS DOING FOR THE INTERNATIONAL EXHIBITION.

IT was unfortunate for the colonies in 1851, that they had not sufficient notice given them to prepare fairly for the great show of the products of the world's industry in Hyde Park. The consequence was, that not more than one-half the space allotted to them in the Crystal Palace was occupied. That evil has been, fortunately, avoided as regards the Exhibition of this year at South Kensington, and a far more satisfactory display of colonial products will be the result. So far as India is concerned, this will be especially the case, for we find that when the lists of applications for space closed —about three months since—ten thousand demands had been made, or two thousand more than in 1851. Ten thousand pounds sterling have been assigned by the Supreme Government towards the expenditure which the transmission of the various articles intended for exhibition will entail upon British India, and private energy and enterprise will supplement the amount by a like, or perhaps a larger sum. In the Paris Exhibition of 1855, Indian productions, raw and manufactured, figured very largely. The native princes of Nepaul, Nagpore, Gwalior, and Rajpootna, forwarded a motley collection of arms, dresses, models, and curiosities of various kinds, whilst private contributors sent matchlocks from Shahabad and Benares, silver ornaments from Dacca and Cuttack, and samples of silk, lac-dye, and indigo from Lower Bengal. There came also shawls from Cashmere, and silks from other districts.

The Court of Directors of the East India Company, from some motive or another, forbade the forwarding of raw products to the Paris Exhibition, but, so far as the Presidency of Bengal was concerned, Lord Dalhousie over-ruled this absurd dictum, and not less than 9,000 specimens of mineral, vegetable, and animal products found their way to the French capital. Great dissatisfaction and discouragement among the Indian contributors to the Exhibitions of 1851 and 1855 followed the closing of both. They had been led to believe that their contributions, if not sold, would be made over to their friends in Europe, but the authorities broke faith with them, and returned them to India, because the import duty had not been paid. In many instances, silk goods thus returned were so damaged that the Government considered it proper not to return them at all! The poor silver-workers of Cuttack sent their delicate and beautiful jewellery to Paris, but much of it was never unpacked, and, by some strange error, the cases containing it were sent afterwards to Bombay instead of Calcutta, and two years elapsed before any compensation was made them.

The effects of this treatment became painfully apparent to the various committees formed throughout India in May last, for the purpose of collecting articles for the Exhibition of 1862. Neither native princes, nor Cuttack workmen, were at all disposed to put their shoulders to the wheel on that occasion. Burnt children dread the fire, and the victims of 1851 and 1855, very naturally objected to becoming victims a third time. Under these rather discouraging circumstances, Mr. Dowleans, secretary to the Calcutta Central Committee, made a very sensible suggestion, and this, fortunately, has been acted upon. He proposed that the government, while inviting private contributions, and undertaking to pay the cost of transmitting them, should also guarantee purchases to the extent of £10,000, the sale to take place in London. This arrangement, as we have said, was agreed to, and the consequence is seen in the freedom with which private contribtutors have since come forward. In Bengal alone, they number seventy or nearly; and the articles they purpose sending reach the aggregate value of £12,000. In the Bombay and Madras Presidencies, similar alacrity has shewn itself. The government investment is to be devoted to the purchase of articles of utility, as well as of beauty, and no doubt a fair percentage of profit will result from the venture. From the western presidency will be sent the table linen of Broach, the velvet embroidery of Sind, the fancy wood-work of Ahmedabad, and the carved furniture of Bombay. Madras will show its characteristics, in the shape of silk carpets from Tanjore, lace from Tinnevalley, cotton carpets from Ellore, gold jewellery from Trichinopoly, mats from Windewash, peacock feather fans from Coimbatore, towels from Chingleput, and muslins, embroideries, and collars, from the City of Madras itself. The articles to be transmitted from Bengal will be of the most varied nature, and it will be only possible to enumerate some of them. They will comprise the delicate and beautiful fabrics of Dacca, the rich carpets of Merzapore, the silks of Berhampore, and Benares, the gold work and scarfs of Delhi, the silver filagree of Cuttack, the mats of Midnapore and Jessore, the baskets and horn work of Monghyr, the lac-work of Burbhoom, the ivory figures of Berhampore, the clay figures of Kishnagur, the soap-stone models of Agra, and the papier mâché of Lahore.

It is intended to prevent as far as practicable, articles being sent over in duplicate, in order that rarity may enhance their value.

The whole of the preliminary arrangements, indeed, appear to have been made with singular judgment and care. Every manufactured article sent is to be of a date subsequent to 1850. The Indian collection in the Great International Show, will thus be positively new, and raw products, to the transmission of which there is now happily no board of directors to object, will, undoubtedly, form a very remarkable feature in it. The industrial progress of British India during the past ten years will thus be made apparent, and we shall be afforded an excellent proof of the extent to which Indian producers and manufacturers have gone a-head, to use a Yankeeism, since the previous display of their materials and works in Hyde Park. A detailed and classified catalogue of the whole is, we believe, in process of compilation at Calcutta, and this will no doubt prove an excellent guide-book to the Indian court.

As many of the more bulky articles and those of comparatively small intrinsic value were to be sent by sea, it is likely that at this hour some of them are being borne towards our shores, and will soon have to "brave the stormy "spirit of the Cape." The more costly, delicate, and valuable contributions will be transmitted overland. Among these may be mentioned an exquisitely finished jewel-case made of silver filagree, after a design by a native artist. This is to be placed on a handsome stand, contributed by Mr. Lazarus, of Calcutta, and intended as a present to Her Majesty. A very extraordinary specimen of Indian workmanship, in the shape of a double-barrelled gun, will, in these days of breech-loaders, rifles, and revolvers, no doubt attract considerable attention on its deposition at Kensington. Though, as may be expected, this will be of peculiar construction, and not equal in its range to the weapons supplied by Westley Richards, or Deane, or others of our celebrated gun mechanists, yet its finish and ornamentation will, we have reason to believe, far excel any of these.

On the whole, there seems to be little room for doubting that our Eastern Empire will be fully and fairly represented at the International Exhibition, or that there will be any grounds for blushing for the display it will make there.

Before leaving this subject it may be well to state, that in the other divisions of our Eastern possessions, China and Japan, great efforts are being made to have those places properly represented also in the coming Exhibition, and separate courts are to be devoted to their products, raw, manufactured, and artistic. Mr. Alcock acts for Japan; while at Hong Kong a committee is dealing with the industrial and other elements of Chinese society. It is highly probable, therefore, that from Japan and China will come some most interesting, and, perhaps, grotesque and curious, specimens of the workmanship of the extraordinary peoples who inhabit those vast territories. It would be unfair to omit stating that in obtaining some portion of the information given in this paper, the *Friend of India* has been also our friend.

SUBMARINE TELEGRAPHY.

A GREAT characteristic of modern discovery is the marvellous principle of growth and reproductiveness which attends it.

Each successive truth of primary scientific value lays open in the present day a number of other avenues to other truths, and becomes at once protean, practical, and utilitarian, hurrying on from phase to phase, and bestowing with every change some tangible advantage or convenience upon society.

The rate at which our modern wonders are consequently developed, can only be appreciated by considering the slow and toilsome march of ancient science, and the infrequent deduction by ancient philosophy of any practical, or generally useful discovery from abstract fact.

This is well illustrated by the career of electrical knowledge. Thousands of years ago, the key to its secrets lay hidden quietly in the then well-known properties of amber and loadstone, and appealed to the senses in the mysterious powers of the torpedo; yet, though powerfully urged by curiosity and wonder, the examination of these phenomena even by such men as Thales and Herodotus, Aristotle and Lucretius, Cicero and Pliny, resulted in nothing but conjectures and conclusions, not merely barren of utility to man, but in themselves the most puerile and unsatisfactory.

Nor were the alchemical and astrological researches into this subject at a somewhat later period in any important respect more fruitful.

At length, in the eighteenth century, a host of great men ardently and enthusiastically seized upon the subject, and, as if by magic, results of the most important and varied character at once began to be developed in rapid succession; a new force was brought to light, its principles were found to pervade and influence all nature; the whole range of physical science was stimulated and advanced, as truth after truth was made manifest, and at length the electric current, with equal tenuity, but with far greater expansibility than the genié of the Arabian tale, glides over earth and under sea in obedience to its discovered law; conveying along its tiny conduits bright streams of commerce, of affection, and of knowledge, to the uttermost parts of the earth. Apt illustration of true great-heartedness!—the lightning, so crashing, so sublime, so strong in the piled-

Digitized by Google

up dignity of the storm-cloud, can yet be constrained by the hand of science to hurry on an errand of usefulness for the poorest and most abject of mankind!

It is now only twenty-three years since the opening of the first effective land line of electric telegraph—that between West Drayton and Slough. Its conductor was covered with cotton, and buried in asphalte, in order to insulate it from the earth.

Eleven years only have elapsed since the earliest submarine cable became an established fact, by conveying intelligence beneath the sea which intervenes between Dover and Calais.

During the period of somewhat less than a quarter of a century that the land system has pursued its career, upwards of 100,000 miles have been erected in various countries, and these 100,000 miles in all probability contain a mileage of conducting wire, equal to at least half a million of miles.

In the brief space of time that has beheld the rise and progress of submarine cables there have been manufactured altogether upwards of 14,000 miles of cable, out of which, owing to the failures of the Atlantic, the Red Sea, and the Mediterranean lines, together with some minor casualties, little more than 5,000 miles remain in working order.

These latter statistics would therefore seem at first glance, and without any explanation, to discourage future submarine telegraphic enterprise. The truth of the matter really has no tendency in that direction; but, on the contrary, offers a greatly enlarged prospect of the successful carrying out of these undertakings, which, now that the blunders that have characterised some of the earlier essays have been swept away, are making considerable progress, and are only waiting the removal of that want of confidence which bad management has thrown over them, in order to develope into a gigantic net-work of sub-oceanic communication.

The idea of telegraphing under water, as well as overland, would seem to have been at a very early period within the mind and intention of those discoverers who first rendered the electric telegraph a practical fact, but the earliest conveyance of the current through an insulated wire submerged in water was effected in India by Sir W. O'Shaughnessy in 1839. He sank a wire in the River Hooghly, and worked through it, using for insulation a composition of bituminous matter.

Subsequently, in 1842, Professor Morse, at the suggestion of the American Institute, obtained signals through a conductor insulated with similar materials, and submerged between Castle Garden and Governor's Island, New York.

Many similar experiments were afterwards made by separate individuals, but very little encouragement was derived from them, owing to the great difficulty experienced in rendering and perfectly keeping the conductor permanently free from contact with the water by means of any form of insulator then known. India-rubber was indeed tried on a short length, by Mr. Charles West, in 1846, and with partial success, but was abandoned on the introduction of gutta-percha in 1847, owing to the many advantages presented by the latter. To the enterprize of the gentlemen into whose hands fell the introduction of this remarkable material, so admirably adapted to the insulation of sea lines of telegraph, and in particular to the unwearied zeal and devotion of their manager, Mr. Statham, who threw himself into the work of adapting gutta-percha to telegraphic purposes, the world mainly owes the existence of the submarine cable.

The difficulties in coating the copper, in making the electrical test, in perfecting the joints in copper and gutta-percha, and in many minor but important portions of the work, have had to be successively, but only progressively overcome. Even gutta-percha was not all at once considered capable of being used for submarine purposes, its only application in the first instance being to cover those portions of the land lines which passed under streets and through railway tunnels.

At length, after experiments by Mr. C. V. Walker, Mr. Cromwell Varley, and others, had shown that the material could be trusted, sufficient confidence was created to allow of the important and memorable trial in 1850 between Dover and Calais. This was made with a single copper wire, coated to half-an-inch diameter with gutta-percha, and sunk to the bottom by means of weights, and, being too frail, was soon carried away, after proving, like the cable laid across the Atlantic, the important truth, of which it was the first illustration. Next year, aided by the zealous efforts, no less than by the purse of Mr. Crampton, the engineer, a permanent iron covered cable with four conductors was laid with great success, and thus the entire field of sub-oceanic electric telegraphy was opened to the adventurous.

In this condition of things there were two circumstances eminently unfavourable to the immediate future of submarine telegraphy. In the first place, the enterprize instead of being, as it might well have been, an imperial work, was in fact a mere speculation in a concession of exclusive rights to land cables on the shores of France, and that it must have been to some of those concerned in it a very valuable one, may be gathered from the fact, that while the capital allotted and absorbed amounted to £75,000, the cost of the cable of 1851 and the experiment of 1850 did not exceed £23,000 at the outside. This was an evil example, and the cupidity and greed inspired by this first success in concession-mongering have more than anything else, tended, until recently, to lower morally and scientifically the entire standard of submarine telegraphy. Secondly, the work of laying this and a few of the succeeding short cables in the channel was, if one may be allowed the expression (looking to the vast expanses of ocean that have yet to be crossed), somewhat *too successful*, or rather success was advanced too easily to enable those who came afterwards to appreciate the full extent of the difficulty to be encountered electrically and mechanically in long cables in deep water, or to benefit by the experience, always so valuable, of those whose energies have been sharpened and warmed into action by difficulty and danger.

The early consequences of success in shallow water, and of the other cause alluded to were, overweening confidence, excessive haste, or rank jobbery in the majority of these enterprises which followed immediately upon the first tide of prosperity in this business, down to the failure of the Red Sea cable; the voice of reason and common sense being constantly hushed and drowned by the control and representations of private interest and pretentious ignorance.

Even the Atlantic Company, undoubtedly honest as was its management, valuable as is its experience, and much as may be allowed for the first initiation of a great and obscure work, was yet confessedly hurried along with mad precipitation in 1857—only to culminate, as might have been expected, in the destruction sooner than necessary of what little life was left in the cable after submersion, in 1858, by enormous battery shocks, and reckless experimenting.

We have in this Journal repeatedly censured, in the plainest terms, the blunders and follies of the early periods of ocean telegraphy, and have endeavoured to raise the true issues, as to its future, by illustrating, from the records of fact and experiment, the more prominent and imperative among the requirements conditional to success in these undertakings.

Experience has now reduced the operation of making and laying short cables in shallow water to a very simple matter. Provided the conductors are well insulated, and that the external wires are of the greatest practicable strength, there will be small difficulty with any future shallow cable. These external wires, however, should be carefully prevented from oxydation before they are laid, by being coated with some indestructible material. The great element of strength, so necessary in this description of cable, is at present being fully recognized in practice by the fact, that a cable is now in course of construction for the Electric Telegraph Company, the weight of which, with its external armour, will be sixteen tons per mile, being nearly double the weight of any previous cable. But when the sea to be crossed is measured by hundreds of miles, and the depth by thousands of fathoms, the conditions of success and permanence are quite altered. Here the questions of size and stowage have to be considered, and that of suitable specific gravity for the greater depths is of paramount importance, as affecting the external covering to be made use of. The precautions in selecting the copper, in the purification of the gutta-percha, in the application of delicate electrical tests, and in adjusting the proportions of conductor and insulator, with a due regard to future speed of working, have all to be redoubled.

It is gratifying to know that all these matters are now recognized, and that looking to the future of deep-sea cables, we see every prospect of success in the thorough and careful manner in which the subject has been taken up by the Government Committee, by the manufacturers of insulating materials, and by the more respectable contractors engaged in the work of covering and laying cables. The almost perfect system now adopted of testing the conductor's insulator at every stage, and by various processes—electrically, by hydraulic pressure, and under various conditions of temperature, leaves scarcely a possibility of defect in the core; and the advisable plan of keeping the entire cable under water, from the time it is made till it issues out into the sea, is a great safeguard against those cases, of which the Atlantic is one instance, where cables, actually imperfect before submersion, have only shown their more serious defects when they have been for some days or weeks at the bottom of the sea.

The cables recently laid in the Mediterranean are still working in a highly satisfactory manner, and at a very good rate of speed, and although neither the Malta or Alexandria line, nor that from Toulon to Algiers, were commenced in time to allow of their being wholly constructed on the most recent experience, nor on the best principles that are now attainable, they are both admirable cables, and bid fair to be works of as much permanence as they are of importance.

It is surely now high time that something were done to lay down good and substantial communications to America, and to India. We confess we have but small faith in the attempt now going on to patch up the Red Sea cable. The whole line is bad in principle, badly laid, and unsuitable to the work, but there can be no doubt that a proper, permanent, and well-working line might now be speedily laid, and that with comparative ease, either from Iceland to Newfoundland, or from Suez to Kurrachee. Of the importance of both these lines of communication it would be idle to speak. The existence of a telegraph to America would most certainly, as matters have now turned out, have saved nearly the whole of the enormous warlike expenses, amounting to not less than a million sterling, which have been inflicted on the tax payers of this country, by the Trent business; and in case that difficulty had ended in war with the United States, a rapid means of communication, both with our North American colonies, and with India, would have been of enormous moment to life and property, besides the facility thereby created for controlling military and naval operations. We trust, therefore, that the present auspicious aspect of the money-market will not be lost upon the Government, as being an inducement to devising some plan to assist great undertakings.

The public will not again run the entire risk of undertakings so imperial in their character, and so costly in their nature, but if the British Government were enabled to so far recognize their importance as to afford them the most moderate help of a substantial kind, they could now be readily and safely accomplished.

WINCHESTER, GRAVELEY, & SAGER'S SHIP-OUTFITTING WORKS.

Except to the shipowners and shipmasters of the United Kingdom, and, indeed, of the world, with whom the name of the above firm is "familiar as household words," it is probable that comparatively few persons know much of Winchester and Co.'s establishment, or the peculiar nature of the work for which they are celebrated. Having ourselves lately paid a visit to their establishment, and watched with considerable interest the branch of manufacture in which they are actively engaged, we think it not improper to give our readers also some idea of the value of their services to the shipping community. The workshops of Winchester and Co. are situated in one of the most bustling localities in London, namely East Smithfield. To those whom business or pleasure has not led to the St. Katherine's or London Docks, it will be well, perhaps, to explain that East Smithfield is the main thoroughfare between the principal entrances of those vast receptacles for the shipping and products of all nations. After passing the Tower of London, and leaving the Royal Mint on his immediate left, the visitor to this part of the east end finds himself in a street bounded on one side by a line of shops, and on the other by the outer wall of the St. Katherine's Docks. The wall in question was a year or two back a "dead" wall. It is now, however, made, so to speak, a living one, for it is illustrated by gaily-painted showboards indicative of the occupations of the various tradespeople in the vicinity, and which speak eloquently of advancement in the art of advertising. No doubt, also, it is made profitable to the Dock Company, who do not permit the showboards to be hung like "banners on their outward "walls" gratuitously.

At about a hundred and fifty yards below the St. Katharine's Dock main entrance then, and facing its illuminated wall, are situated the works of Messrs. Winchester, Graveley, and Sager, and a conspicuous display of ships' fittings of iron and brass, and more especially of those connected with cooking and distilling appurtenances, tells of the nature of their occupation. On entering, one sees on all hands proofs of the ingenuity and skill with which the various requirements of those who "go "down to the sea in ships, and do business on the great deep," have been provided for, and ministered to. It would seem, indeed, from an examination of the appliances on all hands visible, that a sea voyage with such accompaniments would be deprived of half its terrors. No doubt the detailed experiences of captains, crews, and passengers have suggested to Winchester & Co. ideas of many of the numerous mechanical conveniences with which they are prepared to supply sea-going ships, but assuredly much praise should be given them for the successful way in which those ideas have been realised.

One of the most important inventions which they have brought to practical use, and one which in many cases must be of inestimable value is the combined "Sea-water Distilling, "Aerating, and Cooking Apparatus." This was contrived and patented by Mr. Graveley, and has been in existence sufficiently long to test its efficiency. By the arrangement of a condenser, pipes, and valves in connection with the cooking apparatus, and in so simple a way as to prevent, except by the grossest inattention on the part of the person in charge, any chance of failure, Mr. Graveley has succeeded in producing a sea-water still, which performs the apparent miracle of making the ocean a great reservoir for the supply of fresh water to sailors, as well as it is the medium of communication between the ends of the earth. It appears to us to be impossible to over-estimate the value of this contrivance, and it is unnecessary, certainly, to descant at length upon it. Setting aside the usefulness of the "Sea-water Dis-"tilling Apparatus" in a sanitary and social point of view, it may be well to regard it in a commercial light, which, after all, is most vital in respect to its general adoption. The ordinary course on board sea-going vessels in making provision for a voyage of any length is to lay in a large supply of water in square iron tanks. These are placed in the ship's hold, and they occupy an amount of space which can ill be spared, and which deducts so much from the accommodation for merchandise, and, therefore, from the owner's profit.

Provided with an apparatus such as that of Mr. Graveley, which is far from costly, except when made sufficiently large for ships-of-war, with complements of 500 or 600 men, all this inconvenience is avoided; the passengers have the advantage of a daily supply of water fresh and soft as rain from the clouds, and the vessel gains stowage room, which properly used will, in a short time, pay the expense of the apparatus.

The best possible testimony demonstrates the fact, that the firm in question have practically and perfectly solved the problem of converting salt water into fresh, or, rather, of extracting the salt from salt water, and leaving it pure and free from saline influences. The Mercantile Marine of England have largely availed themselves of this scientific, yet simple adjunct, and in Russia it has been extensively patronised both by the Government and merchants. Messrs. Winchester and Co. were, when we visited their works, engaged in remodelling on the principle of their own distilling apparatus, one which the Russian Government had made for themselves at Cronstadt, and which had been placed on board His Imperial Majesty's frigate Oslaba, now lying at Greenhithe. Although the workmanship of the Russian Sea-water Distillery was excellent in itself, the makers had failed in creating a serviceable apparatus, through sundry oversights as regarded the principle of its construction, and hence their reference of it to the firm named. We believe that the Government Emigration Board have it in contemplation to rely entirely in all vessels fitted under their control upon Graveley's Distilling Apparatus for the supply of fresh water to the emigrants on board them, and we must say we think they would be wise in coming to such a conclusion. There is really no room to doubt that the health of passengers and crew would be benefited by the change from stagnant tank water to that with which the apparatus would daily supply them in abundance.

Messrs. Winchester and Co. manufacture the whole of their work themselves, and have extensive stores in the rear of their premises as well as below the basement. They have a small steam-engine, also of their own make, for putting in motion the various lathes and other machinery, and for working the fans in connection with their range of forges, and altogether the establishment is one eminently calculated to effect the purposes to which it is devoted.

The printed code of directions for the management of the distilling apparatus, as supplied with each, is sufficient to demonstrate the simplicity of the contrivance, and the small chance there is of its derangement under any ordinary circumstances. We have spoken at some length, and very eulogistically, of the sea-water distilling apparatus of Mr. Graveley; it is because it is at once a great boon to the shipping interest generally, and an important addition to the scientific inventions of the time.

ON THE METALLURGY OF COPPER & ZINC.

(Continued from page 16.)

Fourth Lecture.

In his fourth lecture, Dr. Percy continued the description of the various modes of obtaining copper from its ores. The chemical reaction that takes place when metallic iron is placed in a solution of sulphate of copper, when the iron is dissolved and metallic copper precipitated (the positions of the two metals being as it were interchanged), is the basis of a process that was formerly extensively followed, but that is now abandoned.

Dr. Percy next proceeded to describe the exceedingly ingenious kernel roasting process followed in some parts of Italy. The ore employed is an iron pyrites, containing a very small amount of copper, not more than two per cent.; it is broken into lumps the size of the fist, spread on a layer of brushwood, and ignited; when the whole takes fire, the sulphur burning with the evolution of sulphurous acid gas, the combustion of the heap continuing for eight or ten months. When the fire has burnt itself out it is found that the outer part of each mass consists of peroxide of iron merely, the whole of the copper being concentrated in a central kernel, which often is so rich as to contain 15 per cent. of metal. The kernel, after separation from the surrounding mass, is smelted in the usual manner.

The working qualities of copper are greatly influenced by minute quantities of other bodies united with it. Phosphorus in very small proportions ensures a good sound casting, and the metal can be rolled when cold, but is brittle when hot, or, as it is termed technically, is *red short*. Copper containing so large a proportion as 11 per cent. of phosphorus is hard, grey in colour, and very sonorous.

When copper is granulated, mixed with a large proportion of sand and charcoal, and exposed to a white heat for three or four hours, it alloys itself with silicon, the basis of sand; these samples of silicated copper possess very remarkable properties. An alloy with 11 per cent. of silicon is brittle; with two per cent. the alloy is tough, strong, and closely resembles gun metal, and promises to be of great value in its arts.

The purity of the copper used in forming the conductors for electric telegraphs is a point of great importance, as the conducting power of copper is greatly lessened by even a small admixture of foreign bodies; taking the conducting

Digitized by Google

power of pure copper at 100, a minute addition of metallic arsenic or of phosphorus lessens it to 6.

The different modes of assaying copper ores were then considered, and in connection with this matter it was stated, that the slag which was thrown aside at Swansea contained ½ per cent. of copper, causing an annual loss of upwards of £30,000.

Zinc, which has only been obtained in a separate state within a comparatively recent period, was certainly known to the Romans, by whom brass coins were made 2,000 years since. Zinc in its ordinary state is a bluish white metal, which is brittle at ordinary temperatures, but becomes malleable when heated, and if rolled in this state, retains its malleability when cold, after which it may be bent without breaking, and may be softened by annealing. On the contrary, if heated nearly to its melting point it again becomes brittle, and when bent crackles like tin. The melting point of zinc is about 800° Fahrenheit. At a bright red heat it takes fire if exposed to the air, producing white oxide of zinc; this, however, is yellow when heated, and may in this condition be often seen escaping from the chimnies of brass foundries. Oxide of zinc is largely used as a white pigment; united with carbonic acid it constitutes calamine.

Fifth Lecture.

Dr. Percy's fifth lecture was chiefly occupied with a consideration of the chemical properties of zinc, and the mode of obtaining it from the ores. The chief ores of zinc are calamine and zinc blende Calamine is a carbonate of the oxide. It was formerly so abundant in England that it has been exported as ballast. At the end of last century 1,500 tons were yearly raised in Derbyshire alone; in 1859 the whole amount in the United Kingdom was 285 tons, chiefly from Cumberland and Ireland. The chief continental deposits of calamine are in Belgium, Silesia, and Carinthia. Recently, however, large and valuable deposits have been discovered in the north-west of Spain.

Blende, or sulphide of zinc, the "black jack" of the miners, is a combination of zinc and sulphur; its name is derived from the German word *blenden*, to dazzle. It is a much more abundant ore than calamine; in 1859, 13,000 tons of it were obtained in the United Kingdom, chiefly from Wales, Cornwall, the Isle of Man, and Derbyshire.

The first process in the reduction of the blende is that of roasting in the reverbatory furnace. This has the effect of burning away the sulphur, and the zinc remains in the form of oxide. This oxide is reduced to the metallic state by heating it in closed pots with charcoal or other carbonaceous matter, when the carbonic oxide produced absorbs the oxygen from the ore, and the metallic zinc, being converted into vapour by the heat, flies off through a tube and is condensed and collected.

Formerly this process was followed very extravagantly. At Swansea, even quite recently, twenty-four tons of coal were consumed in the reduction of one ton of zinc. An improved form of retort for effecting the reduction is now employed, and the cost has consequently been diminished to less than one-half of what it was formerly by the old furnaces. The improved method of reduction is termed the Silesian. Furnaces acting on the same principle, but differing considerably in detail, are also employed in Belgium, at the works of the well-known Vieille Montagne Company.

Sixth Lecture.

The consideration of the foreign materials always present in commercial zinc is one of considerable practical importance. Iron and zinc alloy readily, and the presence of a minute quantity of iron renders the zinc unfit for rolling. When iron is present, it it indicated by minute grey specks on the bright crystalline surfaces of a freshly broken ingot of zinc.

When lead and zinc are melted together and cast, the lead always is found in greater quantity on the bottom of the casting, but zinc cannot be completely deprived of lead in this manner.

The affect of the presence of lead on the quality of zinc is a matter of some dispute, some observers stating that its action is very detrimental, whilst others allege that the inferior quality of the zinc under experiment depends on the mode of working.

In preparing ingots of zinc for rolling, the practice is to allow the lead to subside as completely as possible.

Brass.—The combination of the two metals, copper and zinc, constitute brass, an alloy which possesses very valuable properties; it is so malleable and ductile, that it can be rolled into thin sheets, shaped into vessels under the hammer, raised by stamping, drawn into wire, cast at lower temperature than copper, taking a sharp impression, and, lastly, it is of a pleasing colour, and is cheap So malleable is brass, that it may be beaten out into leaves not exceding the [illegible] of an inch in thickness.

The composition and qualities of brass vary very much with the purposes to which it is applied. Thus, the presence of a little tin is a good addition to brass used for door plates, as it causes the metal to break up short under the graver. Brass for turning has usually about 3 oz. of lead added to every 10 lbs., the addition being made after the crucible is removed from the furnace; the addition causes the turnings to leave the tool readily.

Brass is very subject to a peculiar alteration in the arrangement of its particles, by which it becomes crystalline and extremely brittle—brass wire, brass chains, &c., often, without any apparent cause, lose their tenacity and become as brittle as glass; hence, it is doubtful whether brass chains should be employed in the support of heavy bodies, such as chandeliers.

The attendance on Dr. Percy's lectures was well kept up to the end of the course. The audience was one of the most attentive and appreciative that we have ever seen. We cannot, however, but think, that a very serious mistake was made in the selection of such a subject for a course of lectures to working men. The practical mechanic desires information of a practical character—facts that he can avail himself of in his every day work; he wishes to be informed respecting the technology and not the metallurgy of the metals. The various conditions affecting the malleability and ductility of metals, the properties of their alloys, the uses of fluxes, &c., &c., these are all of importance to him; but the mere description of the intricate reactions which occur in the reduction of copper ore, to an audience not engaged in copper smelting, appears to us to be not the best employment of their time.

NAVAL ORDNANCE.

At the last session of the Royal United Service Institution, Commander Scott gave two valuable lectures on Naval Ordnance, which are well worth the perusal of all interested in the subject. The following is the concluding portion of the second lecture, which we take from the last number of the *Journal* of that Institution:—

"I have now," said Commander Scott, "to point out that the simple elongated iron shot is superior to the compound for storage and carriage, that it does not cost half so much at first, and, while the iron shot can be re-fired for practice, neither the leaded nor the zinc-ribbed shot can.

"In a sea-way, a wad would be required to keep the charge from moving; it is doubtful whether this could be safely used with the shunt, and still more questionable in the case of expanding projectiles, which, by closing the windage, cut off the gas, that, with an iron shot, would pass by and drive the wad out before it.

"The expanding lead shells also are, from the weight of lead affixed to their rear, obliged to have a considerable thickness of iron in front to counterbalance that weight, and a corresponding reduction of thickness at the centre; this makes the shell weak and of less value for breaching.

"All leaded shot carry a great weight of lead, merely for the purpose of taking the rifle grooves, and this soft mass is very liable to get out of shape, and to stick in the bore on loading; and, while the lead coated projectiles are less than the diameter of the bore of the gun, the iron shot have the advantage of the additional width of the projections which extend into the grooves.

"As respects the finely-grooved breech-loader, it is clear that the strain of starting the projectile, wedging it through a narrow hole, and again nipping it at the muzzle, must be very great, and that every successive shock must tend to weaken the whole fabric of the gun, as well as to disintegrate the metal of the vent-piece.

"It is likewise apparent that the friction caused by forcing the projectile to cut its way out of the gun is so much propelling power lost, and this power is really expended in destroying the gun, which absorbs it.

"How, then, it may be asked, can this loss of power be avoided? The answer is, by using an iron shot, and if, as some suppose, hard cast-iron bearings will not answer, there is no difficulty in softening or coating them.

"The advantage of breech-loaders is very doubtful, for both the vent-piece and screw, and also the wedge, are liable to get set fast, and the flat surfaces presented by both these stoppers occasion a damaging shock to the breech, more especially at high elevations. This effect is avoided, or ought to be, in the muzzle-loading rifle by chambering the bottom of the bore. Breech-loaders are certainly unfit for exposed situations, and have as yet not given satisfactory results between decks, while the additional metal required in the rear adds considerably to the weight of the gun.

"Whatever may be decided respecting breech-loading *per se*, it is not to be denied that the leaded compression system, which cannot be used without breech-loading, is the most trying of all systems to the breech apparatus, and it therefore becomes a question whether it is not advisable to give up the plan, for the sake of securing the safety, or at least the longer life, of the gun.

That the fine grooving itself is not advantageous with large guns has been already in part shown, but the reduction in the projectile's velocity from friction, would be a great drawback to the value of any rifled weapon, and it led to the partial adoption of the shunt-grooving for the navy.

"The want of flatness in the trajectory of the 100-pounder shot affords a sufficient proof of this reduction of velocity, but with guns of larger bore the loss would be still more serious.

"The fact is, that a soft metal yields too much to give sufficient rotation to a heavy shot, or to prevent its gravitating towards the lower surface of the bore, and, if the metal coating be made harder, the strain of squeezing it through the bore would be too great for the gun.

"The author of the finely-grooved ordnance stated at the C. E. Meeting 'That the projectile should rule the gun,' and hence, having adopted the built-up segmental shell (patented by Holland, in 1854), he had devised 'the form of gun most suitable for throwing it.' This seems to have been a mistake, for improvements in projectiles are quite as likely to take place as improvements in the cannon which fire them; and by this rule an improved projectile might necessitate a change of gun.

"But this built-up projectile is in my opinion inferior, and gives less sure results than those which could be obtained from an elongated shrapnel shell (with a powder charge in the rear), which on bursting would be certain to scatter destruction *in front* as well as at the sides.

"It is hardly necessary to mention that there is no practical difficulty in holding an iron shot by studs sufficient to detain it in its place, and prevent the possibility of its sliding too far, in loading from the breech; and such studs could be affixed to the shot, so as to be easily knocked off, in loading from the muzzle.

"As to the precision attainable by iron projectiles, this in all plans mainly depends upon the accuracy of fitting, and, were it to be properly carried out, extraordinary perfection would be attained, without at all injuring any of the qualities required by a naval gun.

"The adoption of iron shot would likewise admit of the use of what promises to be a formidable means of offence, viz., a flat-headed shot with a powder shell having a percussion fuze in its rear. Such a shell, if fired from a powerful gun, would penetrate the armour plate and then discharge its mine in the side of an opponent.

"But ordnance, as before stated, should be of from eight to ten inches calibre, or more, and, were the present lengths of guns reduced, greater facility of loading would be attained, and thus really powerful rifles of ten inches bore could be constructed, so as not to weigh more than our present sixty-eight pounder cast-iron guns.

"Such rifle guns would fire a round ball of 136 lbs. weight (at close quarters), and also an elongated shell of about the same weight, containing nearly 20 lbs. of powder. Such guns would be simple also, and the effect of their projectiles would resemble those of the concentrated broadsides, that future warfare with plated ships will necessitate; and I cannot close these lectures better than by quoting the words of the preface to the Emperor Napoleon's admirable treatise on the past and present of artillery, where he says:—

"'Whatever is complicated fails in producing good results in warfare; the promoters of systems forget always that the object of progress ought to be, to obtain the greatest possible effect with the least possible effort and expense.'"

LONDON FIRES.

Mr. Eyre M. Shaw, the superintendent of the London Fire Engine establishment, has, in pursuance of instructions received from the committee for managing that establishment, presented his report on fires which took place in London and its environs during 1861. We gather from the report the following particulars.

The total number of calls received during the year 1861, has been 1409, of these 89 were false alarms, 137 proved to be only chimney alarms, and 1,183 were fires, of which 53 resulted in the total destruction of buildings, &c., 332 in considerable damage, and 798 in slight damage. The fires of 1861, compared with those of 1860, show an increase of 127, and compared with an average of the 28 years during which the establishment has been in existence, the increase is 391. This list does not include trifling damages by fires, not sufficiently important to require the attendance of firemen. Of these no record is anywhere kept, but they may be estimated in round numbers at 4,000; neither does it include the ordinary calls for chimneys on fire, which may be roughly estimated at 3,000.

The totally destroyed list 53, is 25 in excess of the same list for 1860, and 13 in excess of the average proportion for the 28 past years. Of the premises burned, 20 were from two to seven miles distant from the nearest station; 25 were used for the carrying on of hazardous trades, such as cabinet-makers, carpenters, hay and straw salesmen, steam saw-mills, &c. Three were completely on fire before the arrival of the engines, and of the remaining number some through imperfect construction, and one from its great magnitude and inflammable contents, baffled all the efforts of the firemen. In the last mentioned case, which occurred in Tooley-street, on the 22nd of June last, and resulted in the almost total destruction of 33 buildings, there is every reason to believe that, but for a serious delay and deficiency of water, and some violent explosions which took place at the commencement, the fire would have been confined to the building in which it originated. In six of the cases mentioned in the totally destroyed list, the supply of water was either late or insufficient.

The manual fire engines and appliances connected with them are in excellent condition. The land and floating steam fire engines are also in complete working order. The land steam fire engine continues to render valuable service. In this engine a great difficulty has hitherto been experienced in getting up steam in a sufficiently short space of time; this difficulty is now obviated by the introduction, inside the fire-box, of a small jet of gas, which keeps the water constantly boiling. By this simple and inexpensive method, two advantages are gained, one is that it entirely does away with the great risk to the boiler and machinery, caused by the sudden expansion which takes place when steam is raised in fifteen minutes from cold water, and the other is that it insures the raising of sufficient steam in less than five minutes, which is all that is ever required for practical purposes. The three new land steam fire-engines recently ordered of the same makers, Messrs. Shand and Mason, will be finished shortly, and as they will always be kept ready for immediate use by the expedient already mentioned, it is confidently anticipated that they will be found more effective, and at the same time more economical, than those worked by manual power.

It would probably be a hopeless task to attempt to put a stop to the steadily increasing use of gas, which is the most economical and convenient of all modes of lighting; but it appears absolutely necessary that some steps should be taken to caution owners of property, particularly in large wharves and warehouses, as to the position and protection of these dangerous lights. These remarks may not be considered unnecessary, when it is remembered that in many of the most valuable buildings in the Metropolis, moveable gas brackets are placed within twenty inches of the ceiling without the slightest protection whatever. It may be laid down as a rule that the jet on the outer arm of the bracket should never be less than thirty-six inches from the ceiling over it, and that it should be protected on the top by a hanging shade, and on the sides by stops on the swivel joints, which should prevent the brackets moving beyond a safe distance. Attention might, perhaps, also be called to the very common and dangerous practice of nailing tin or iron on the adjoining timbers. This has long proved to be no protection, and it has the disadvantage of allowing the timber to be charred completely through before it is known.

THE NEW HOUSES OF PARLIAMENT AT SYDNEY.

From New South Wales we learn that the designs for the new Houses of Parliament to be built at Sydney, and of which twenty-one were sent in, have at last passed under the examination of the Board of Commissioners appointed to examine them, and that for two of them premiums have been awarded. On the 9th of November the Commissioners met, and were unanimous in their adjudication. The first premium of £600 was given for the design sent in under the motto "I bide," and the second of £300, to that under the motto, "*Hora e Sempre.*" Upon opening the sealed papers accompanying these designs, the Commissioners found that the first was the production of Mr. William Henry Lynn, of Sackville Street, Dublin. It is in the Gothic style, its most prominent feature being a succession of lofty Moorish towers, including a campanile; the pitched roof and windows being richly ornamented. The charm of the design is said to consist in the relief afforded by the broken outline, rich effects being produced by frequent and ornamented projections. The cost of carrying this design into effect is estimated by the Colonial Architect at £642,205.

The architects who have been fortunate enough to obtain the second premium, are Messrs. Stent and Laver, of Great Portland Street, Portland Place, London. They sent, however, two designs under the motto "*Hora e Sempre,*" the one Grecian and the other Gothic. The classic design presents a row of Corinthian columns, with massive entablature and pediment, and crowned by an octagonal tower. In the Gothic design there is a central tower so symmetrical, and so richly and yet chastely decorated, as to compensate completely for its want of height. The perspective view presents a beautiful ideal of Gothic architecture.

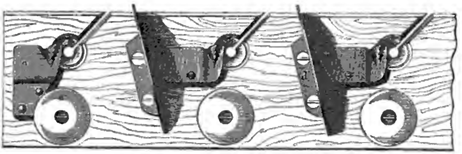
In considering their award in this case, the Commissioners regarded both designs favourably, but actually gave it for the last named. The estimated cost of realizing the Grecian design is £656,641, that for the Gothic £505,113. Messrs. Stent and Lavers are the architects for the parliament buildings now being erected at Ottawa, Canada West, the foundation stone of which was laid, it will be remembered, by the Prince of Wales, in August of last year. Five only of the competitive designs were the production of colonial architects, who are somewhat disappointed, though possibly not surprised, that success has not attended their efforts.

MARINE ENGINE IMPROVEMENT.

Within the past twelvemonth substantial progress has been made in the reformation of our marine steam engineering practice. A large number of commercial steamers, and a few Government vessels, have been supplied with surface condensers and steam-jacketted cylinders. Of the direct saving thus effected we have already had proof. Indirectly, moreover, much has been done. Boilers fed with pure water are likely to last much longer than those liable to frequent, if not chronic, "scaling." The certainty of an abundant supply of distilled water being secured, we shall, undoubtedly, venture also upon boilers of a construction suitable for higher pressures, and with the protection of the cylinders already afforded by jacketting, we shall, as, indeed, many engineers already are, work our steam very much more expansively. In considering what may be accomplished, the fact is suggestive that surface condensers of almost the identical construction of those now in the Mooltan steamer, were tried, on an extensive scale, twenty years and more ago, and finally abandoned. Samuel Hall worked for years to bring surface condensers into use, and yet, while meeting with occasional success, he finally lost ground altogether. With this fact, and the results now obtained from condensers so much like his that it is not easy to distinguish the difference, we have an illustration of how much there often is of accident and prejudice in the way of any useful change. But although surface condensers, of almost the original type, are now in successful use, there are others bearing evident marks of improvement. The enormous surface, from 7 to 10 square feet per indicated horse-power, of the earlier condensers, is no longer found necessary. With means for insuring a better circulation of the water, 2½ to 3 square feet are now found sufficient, and where very high pressure steam, worked very expansively, as in Rowan's engines, is condensed, even as little as 1½ square feet per indicated horse power are found to answer.

It is our belief that one of the most important steps yet to be taken in the path of improvement, is that of increasing the working speed of our engines. We are working 7ft. pistons at 300ft. per minute, where we ought to be running 5ft. pistons at 600ft. The saving in dead weight would, of itself, be very great, it being understood that the high speed engines were accurately counterweighed, and, moreover, steam can be worked with more economy where there is little time for cooling in the cylinder. To work at a high speed, we should either require to have a long stroke, which, in the case of screw engines, would seldom be admissible, or we should else be compelled to resort to gearing—reversing the usual practice with geared engines, of getting up the speed from a slow-moving piston, by bringing down the speed of an engine making 100 revolutions or so per minute to a propeller shaft working at forty or fifty turns in the same time. If we were to judge by the general practice of marine engineers in "gearing up," we might conclude that spur wheels are not at all objectionable on board a steam vessel, and we should no doubt have them in war vessels were it not that the great spur wheels reaches above the water line. In gearing down the speed, however, this would not be the case, as the large wheel need hardly exceed one-third the diameter of the propeller. The pinion or "jack wheel" would be placed to one side, instead of at the top or bottom of the main wheel, and thus, by carrying the crank shaft to one side of
the ship, room would be afforded for a

SCHUTT'S IMPROVEMENTS IN SPINNING FRAMES.



of connecting rod, which, in many cases, is now less than twice that of the stroke. Or the pinion could be placed at or near the bottom of the main spur wheel, and thus lower the foundations of the engines, which, in ships with flat or nearly flat floors, is in itself an important matter, and one by which, in many cases, room would be afforded for an additional deck over the engines.—*The Engineer.*

SCHUTT'S IMPROVEMENTS IN SPINNING FRAMES.

This invention by Mr. H. Schutt, of Bradford, Yorkshire, consists in placing catches, made by preference of spring steel, under the top board or spinning frame, near the "potguides," through which each thread passes, so that during the regular spinning and filling of the bobbins the thread will never come in contact with the catches. But when the thread breaks it begins to fly and sling, and is thereby brought into the catch, which secures the loose wool, and does not allow it to go to the spindle.

In order that the bobbins when being removed may not come in contact with the catches, wooden shields are provided, which the bobbins must of necessity touch. The accompanying engraving illustrates the underside of a top board, to which the catches and shields are fixed. *a a*, are the spring catches, *b b*, are the "potguides," and *c c*, are the shields. In order that a broken thread should not be drawn towards the next thread by a draught of air, guards *d d*, are provided, which in some cases may be dispensed with.

SAMUELSON'S AUTOMATIC REAPING-MACHINE.

It will be within the recollection of almost of our readers, that the American department of the Great Exhibition of 1851 contained, amongst other marvels, or supposed marvels—an uncouth looking two-wheeled carriage, with sails as well as wheels, a couple of seats, and standing room, as it seemed, for several more passengers—which the daily press unhesitatingly described as the Yankee flying machine.

Better information converted this eighth wonder into the more humble, but perhaps not less useful tool, the reaping-machine, now so familiar to us all, but which until then had long lingered on Northumbrian plateaux, in Cumbrian valleys, and in solitary Scottish homesteads; had been carried across the Atlantic, rendered practical there, and had been returned to us just in the very nick of time, when the abolition of the Corn laws and the growing demand for labour in the factories, obliged farmers to cast about them for every aid which mechanical skill could afford them.

These machines cut the grain, and, with the assistance of their sails or reels, laid it upon a platform, from which, as soon as enough had been gathered to form a sheaf, the long, sinewy, and fleshless arm of an honest son of the prairie, imported for the purpose, contrived—*non sine labore*—to rake it sideways on to the ground, where it lay till a gang of labourers tied and set it up in the field. He found the long-strawed, heavy-ed crops of our wheat lands, a very different task from the light sheaves to which he had been accustomed, more especially if they had to be pushed sideways as well as backwards, in fact, into the track the horses were leaving, so that in their next round, the bundles might not be in their way. The difficulty was less when the sheaves were left *behind*, and tied up as fast as they were "delivered," but, at the best, it was found to be heavy work for the attendant; and this, added to the many other imperfections of the early reapers, long proved an impediment to their adoption.

The need of a self-acting delivery soon provoked the efforts of mechanics on both sides of the Atlantic. Indeed, it was found that it had been foreseen and partially provided for by one of the earlier inventors of the reaping machine, the Rev. Patrick Bell, of Carmaylie, who used an endless apron, which deposited the cut grain in a continuous swathe at the side. This construction involved difficulties of detail, which called forth the energies of many of our leading implement makers, as the Crosskills, and of amateurs, as Lord Kinnaird; and a reaper by Crosskill, having an endless webb, cutting 8 feet in width, not drawn, but literally propelled (for they walk behind it) by horses, gained the grand prize of the Royal Agricultural Society last summer. Another, and a very celebrated machine, having a swathe delivery, invented by Mr. William Burgess, of the well-known Newgate street firm, accomplished the same object by means of a series of archimedian screws. Both these machines have been so long before the public, and their merits and defects are so well ascertained, that it is needless to state them; but it is evident that if a simple and efficient machine could be constructed, which should dispense with the reel, and at the same time deliver the grain automatically in sheaves, not in swathe, much complication would be avoided, and a great deal of subsequent labour saved. Nor have efforts been wanting in this direction, at least, in respect of the sheaf delivery. For instance, Atkinson's self-acting reaper, imitating the motions of the human arm to perfection, Samuelson's Britannia, and Wood's automaton have been introduced, and worked with various degrees of success. Still the reel remained an encumbrance, besides often running counter to the movements of whatever mechanism was contrived to deliver the sheaf.

This last difficulty appears to have been at length solved, in a reaper which Mr. Samuelson has imported from the United States, modified and introduced to our harvest fields.

In this machine, the reel and the rake, or sheaf deliverer, are, as it were, concentrated in a single apparatus, which, at once brings the grain *to* the cutters, like the old reel, and removes it at intervals *after* it is cut, like the rakes of the various self-rakers previously spoken of. Besides the well-known constituents of the ordinary reaping-machine, it has a vertical shaft, whose base is in a line with the knives, but, of course, beyond and clear of them. This shaft, which revolves, carries a number of rakes or sweepers, so guided by a stationary cam surrounding it, that they enter the grain sideways, bring it back towards the knives, traverse the platform on a level, sweep off a sheaf, then rise so as to clear themselves from it, and drop into the standing grain at the next revolution.

To discuss the details of Mr. Samuelson's new reaper, is more within the province of our agricultural contemporaries than of this Journal. According to the reports of the *Agricultural Gazette*, *Bell's Messenger*, and other farming authorities, it worked efficiently during the last harvest in various parts of the United Kingdom, but more especially in the border counties of Scotland and the Lothians, where reaping-machines are better understood and more generally used than in any other part of these islands.

We ourselves saw it do good service in Oxfordshire, and the opportunity, which we had lately at the annual Birmingham cattle show, of again examining its mechanical construction, has by no means diminished the favourable impression which it made upon us on the former occasion.

THE BAMBOO AND ITS USES.

This is one of the most useful plants in the world, especially to the Chinese. They rear it from shoots and suckers. There are about sixty varieties of it, but the yellow species is the most common. The tender shoots are cultivated for food, and are, when four or five inches high, boiled, pickled, and comfited. The roots are carved into fantastic images of men, birds, monkeys, or cut into lantern-handles and canes, or turned into oval sticks for worshippers. They are used for all purposes that poles can be applied to, in carrying, supporting, propelling, and measuring, by the carpenter, and the boatman; for the joists of houses and the ribs of sails, the shafts of spears, the tubes of aqueducts, and the handles and ribs of umbrellas and fans. The leaves are sewed upon cords to make rain cloaks, swept into heaps to form manure, and matted into thatches to cover houses. Cut into splits and slivers of various sizes, the wood is worked into baskets and trays of every form and fancy, twisted into cables, platted into awnings, and woven into mats for scenery of the theatre, the roofs of boats, and the casing of goods. The shavings even, are picked into oakum, and mixed with those of ratan, to be stuffed into mattresses. The bamboo furnishes the bed for sleeping, and the couch for reclining; the chop-sticks for eating, the pipe for smoking, and the flute for entertaining; a curtain to hang before the door, and a broom to sweep around it; together with screens, tools, stands, and sofas for various uses of convenience and luxury in the house. The mattress to lie upon, the chair to sit upon, the table to dine from, food to eat, and fuel to cook it with; the ferule to govern the scholar, and the book he studies, both originated here. The tapering barrels of the *sang*, or organ, and the dreaded instrument of the lictor, one to make harmony, and the other to strike dread; the skewer to pin the hair, and the hat to screen the head; the paper to write on, the pencil handle to write with, and the cup to hold the pencils; the rule to measure lengths, the cup to gauge quantities, and the bucket to draw water; the bellows to blow the fire, and the bottle to retain the match; the bird-cage and crab-net, the fish-pole, the water-wheel and caveduct; wheel-barrow and hand-cart, &c., are one and all furnished or completed by this magnificent grass, whose graceful beauty when growing is comparable to its varied usefulness when cut down.—*Scientific American.*

It has been ascertained that iron telegraph wires which pass near foundries, furnaces, and all works where there is a great deal of smoke, soon oxidize. This is said to be due to the sulphurous acid in the smoke; carbonic acid exercises a more moderate action upon the iron.

Record of Wrecks.—We, *Shipping and Mercantile Gazette*, publish to-day our usual monthly record of wrecks, from which it appears that the number of wrecks during the month of December was 202, in February 285, in March 133, in April 149, in May 142, in June 115, in July 91, in August 108, in September 146, in October 119, and in November 298—making a total during the past year of 2,029.

WARNER'S IMPROVED ACHROMATIC BI-LENS AND SAFETY LIGHT APPARATUS, FOR THE EXHIBITION OF DISSOLVING VIEWS.

Mr. Warner, of 72 Fleet-street, has recently introduced a very remarkable apparatus for the better exhibition of what are known as dissolving views. He has endeavoured, and very successfully endeavoured, to heighten the effect produced by those attractive representations. Those only who have had the opportunity of inspecting the apparatus above named, and seen the effect produced by it, can realize the value of the invention. For the illustration of pictures, whether in public or private, such an adjustment must prove invaluable. The portability of the contrivance, too, is a strong recommendation to it. The inventor, himself a skilful mechanic, has taken special care to meet, and overcome the evils and annoyances which have hitherto attended the exhibition of dissolving views. The hydro-oxygen burners, on a different plan to any before contrived, have great advantages as compared with the burners generally used, and the mode of making the oxygen is novel, effective, and safe.

Now that the nation is recovering from the first shock caused by the decease of the Prince Consort, those whose mission it is to administer scientific recreation to the juvenile portion of the community, may begin to "take heart again," although their "occupation" for a time has been well-nigh "gone." Among the most interesting branches of scientific amusement, assuredly the exhibition of dissolving views may be named, and we commend the apparatus of Mr. Warner to the notice of our readers, old and young, with the ertainty that they will on witnessing its effects, hank us for doing so.

MPROVEMENTS IN FLAX SCUTCHING MACHINERY.

Ve had the pleasure of inspecting, at the ork-street Foundry, a highly-important improvement, which the inventor of "Rowan's Patent lax-Scutching Machine" has just perfected and ntroduced. Our readers are, of course, aware at last summer Mr William Rowan solved one the main difficulties in flax-scutching, by inenting a machine which, at a small cost, with ttle labour, and at low power, performed the eration in a manner superior to any scutching achine previously constructed. This machine as at once taken up by the trade of the United ingdom, and was exported in large quantities to e continent and to Canada, where it was most vourably received, as our readers must have served from time to time by extracts published our columns from other journals. In the course working, however, it was found that the ends the flax were not so thoroughly cleaned as might desired, and that when weak flax was being d the fibre was sometimes tangled and broken. e defect was not so great as seriously to impair efficiency of the machine, but the inventor not satisfied to leave any imperfection in this chine, and accordingly, set to work to remedy It was found that the defect lay in the unlding nature of the "beaters," which, being d, necessarily treated all straw and fibre alike, with an equal amount of force. Compensa- for this was sought in the direction of a ring' 'n the drum, which would accommodate the differences of fibre. In experimenting his direction, Mr. Rowan hit upon a most tiful application of centrifugal action, which, ts effect on the "beaters," completely and tually accomplished the object sought; and, ng patented the improvement, he has now ght it into operation. The extent and value is improvement, are immediately apparent to a non-professional eye; and it has a recommendation in the fact that it will not to the cost of the machine, and can without ulty be applied to all machines already in ation. It is really a matter of no slight im- nce to Ireland to have perfect and cheap flax-scutching machines; which can be obtained and worked by flax-growers themselves on their own farms; and this Mr. Rowan has now apparently accomplished.—*Northern Whig.*

PROPOSED IMPROVEMENTS IN THE METROPOLIS.*

By Edward Finch.

I will explain the improvements and changes I propose to make in the river; and while I am doing this the reader must please assume that the whole of the sewage is disposed of, and that none of it is brought into the river as sewage at any point.

On looking at a map of London, and its environs, it will be seen that the River Thames at Greenwich, at about Deptford Creek, makes a bend forming nearly a right angle; that it keeps on for nearly two miles till it gets to Limehouse, there it forms another sharp bend, then it goes on in an irregularly-shaped line for about four miles until it gets to a point between Waterloo and Hungerford Bridges; there another right-angled bend is formed; the river then goes on for about a mile and three-quarters until it reaches Nine-Elms, there it forms another bend and goes on to Chelsea. These four bends cause the portion of the river extending from Greenwich up to Vauxhall-bridge to form three sides of an irregularly-shaped long square.

Now I propose to cut off this portion of the river, commencing at about Deptford Creek, and terminating at about Nine Elms, and form it into an extensive lake or dock seven miles and three-quarters long. I propose to do this by putting gates across the river at a point a little above Greenwich, adapted for the largest-sized ships to pass through, and at the upper or Vauxhall end of this great lake, to place smaller gates, adapted for barges, river steamers, and small vessels to go through. These gates or locks will be connected by masonry to the shores of the river on each side, and will retain the water in this lake always at one uniform level or thereabouts.

I further propose to cut an entirely new bed for the river, commencing a little above the upper gates of the new lake at about Nine Elms, and carry it in a line as nearly as possible straight to Greenwich, there to let it join the present river bed immediately below the lower gates of the new lake, at a point about Deptford Creek. This new river bed will probably cross the Kennington Oval, take the direction of the Surrey Canal for some distance, and then go on to the point described; the entire distance will be a little under five miles.

As I should prefer to fill the great lake or dock, and to keep it filled, with fresh water rather than with water brought up with the tide. I propose to throw a weir across the river at a point about Hammersmith, and bring down to the lake, by means of a canal or feeder, which I propose to form, a constant supply of fresh water. It will be seen from the Plan (on next page) that this canal will cross and connect with the Kensington and Grosvenor canals, and bring them into direct communication with the great lake, and will bring the great lake and those canals also into direct communication with the upper portion of the river, or that above the weir, and that it will provide water communication with all the districts it passes through. It will further be seen that, by means of locks, barges and vessels may at any time be transferred from this canal or from the great lake into the river at Nine Elms, and pass down the new cut out to sea; and at the Greenwich end of the great lake locks may also be formed, by means of which moderately sized vessels may be transferred from the great lake to the lower portion of the river almost at any state of the tide.

[Mr. Finch here explains his plan for the collection, treatment and disposal of the sewage of the Metropolis, which our limited space prevents our inserting.]

When it is determined that the great lake shall be formed, the advantages of spacious quays on its margin will reveal themselves; the facility with which a new road from Westminster to the City may be made (the intercepting main drain at the same time being formed) near the waterside, will be seen. The advantage of putting our finest buildings upon the margin of this lake will be apparent; in fact, the banks of the river, instead of being, as now, avoided as a nuisance, will be selected as the most healthy and beautiful sites for the finest structures in the metropolis.

In the construction of the new river bed from Vauxhall to Greenwich, a large quantity of material will be excavated that may be usefully employed in forming the quays on the banks of the great lake. It can be used to raise and form new streets on each side of the new cut; and the surplus can be profitably employed in raising the low marshy land on each side of the river below Greenwich.

On the Isle of Dogs spacious graving docks for building, repairing, and laying up vessels, may be constructed, having at one end a communication with the great lake, and at the other an opening into the river. Here ships of war of all sizes could be kept out of water, in store as it were, under cover, fully equipped ready for sea, so that it would be only necessary to admit water to them, and they would in a few hours be afloat and ready for action. These graving docks so constructed, together with the present West India Docks, would, at any time when required, form additional entrances for ships from the river to the great lake.

As the water in the great lake will always be at one uniform level or thereabouts, steamers plying upon it will land their passengers at fixed points on the wharf. All the unsightly landing steps and stages that cumber the river and obstruct its navigation will be swept away. The laborious work of landing coals and other goods from barges on men's backs may entirely be done away with, and steam or other economical power be used at fixed points, where the barges in succession could be brought and unloaded.

There being no tide or current in the lake, small tug steamers could move long strings of barges in all directions. The water being free from all sewage impurities, it would be fit for many, if not for all domestic purposes. Baths could be constructed on its margin, or float on its surface. In case of fire the lake would always be a reservoir to fly to, the water always being at a high level, and the many obstructions to the navigation that would then be useless removed, the lake would be used much more than the river now is as a great highway from west to east, and a greater number of steamers would ply upon it than now ply on the river. Manufacturers on either side could be supplied with abundance of water, and could discharge their waste water into the sewers; and, in dry weather, the streets for some distance could be easily watered from the great lake. Between London Bridge and Greenwich the river would be one spacious dock, adapted to the requirements of the largest ships afloat. Here the Great Eastern could have her wharf and steam cranes, and ships of all sizes, containing or taking away goods of all kinds, could have arrangements provided to meet all their wants, and find quick dispatch. Extensive stores would here be constructed, and railway tracks would lead into them from all the main lines, and the value of the Thames Tunnel would then be discovered.

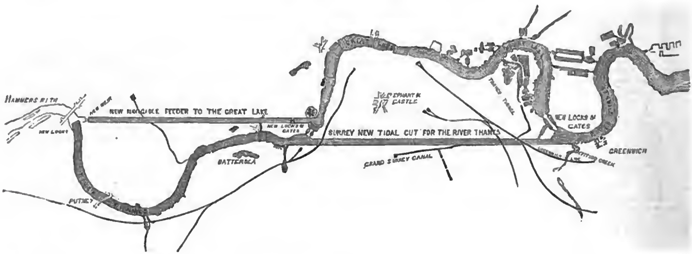
At all times the great lake would be pleasant to look upon, and in the summer season would be used as a great place for recreation and enjoyment.

On the river-wall, at the new Surrey cut for the Thames, places for landing passengers would be formed; and the banks of this cut would form good positions for extensive manufacturing establishments. Up it the tide would daily ebb and flow, and down it would come all the surplus fresh water from the river above: the channel being

---

* This proposal for metropolitan improvements, with a plan for the collection and disposal of the sewage of the metropolis, was submitted to the Board of Works in 1858, and placed before the Thames Embankment Commission in 1861.

PLAN OF FINCH'S PROPOSED IMPROVEMENTS IN THE METROPOLIS.



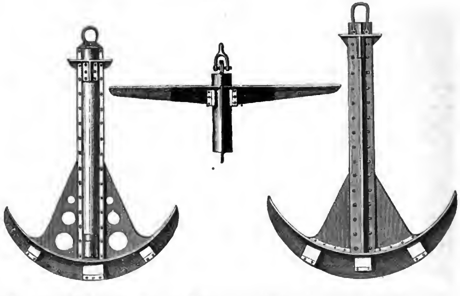
confined by walls, no mud banks would be formed, and at all times of the tide there would be water for steam-boats, barges, and other small craft. The land on the banks of this cut would be greatly increased in value, and the stores and works that would here be erected would enable many offensive trades to be removed from the heart of the city, and would relieve the great lake from excess of traffic. A large number of passengers that now go from the east to west end would find the route by the new cut much the shortest, and therefore would adopt it. The direction being straight, the distance diminished by two miles and three quarters, and the obstructions caused by bridges greatly reduced, the tide would rise higher and flow longer in the upper portions of the river than it now does. The present docks would none of them be interfered with, but would all be benefitted by the changes proposed, and all the canals would be turned to good account.

The feeding reservoir for the middle main intercepting drain on the north side of the great lake may be formed into an ornamental sheet of water; the water that is forced from the lake into it may pass through fountains, or fall in cascades as fancy may dictate. A large portion of the town may be supplied with water for domestic purposes from it; and it would always be valuable in case of fire, and useful to water the streets with.

To carry out this project will be a great undertaking, but not greater than London's requirements. It will confer vast benefits on the metropolis; it will interfere with no private property or interests injuriously; and will in the long run turn out to be a highly profitable investment of the nation's money.

WILSON'S PATENT ANCHOR.

Fig. 1. Fig. 2. Fig. 3.



WILSON'S PATENT ANCHOR.

This invention, recently patented by Mr. R. Wilson, shipowner, of Liverpool, consists in making anchors of boiler-plates with the shank hollow, forming them of longitudinal pieces of plate iron or "homogeneous" metal, the edges being turned up to form flanges, which are riveted together. The plates used in building these hollow shanks can be so shaped that the cavity in the centre may be round, square, or of any other suitable shape; and in some cases, where very great strength is required, mid-feathers are introduced, extending down the whole or a portion of the length of the shank.

The anchor arms are constructed of such a form that in cross section they will resemble the letter T, the lower limb forming a strengthening ridge on the outer side. The arms may be formed of one piece of metal bent to the required shape, and pointed at each end, or the upper portion may be made of a plate pointed at the ends, and bent to the desired form, and strengthened by riveting on to the convex side thereof a piece of T-metal bent to the required shape. The shank and arms are united by means of rivets passing through collars of angle iron or steel surrounding the bottom of the shank, and by a metal plate or plates placed edgeways, and running from the arms to about half way up the shank.

The stock can be constructed in the same way as the shank or arms.

In the construction of various parts where great strength is desired, it will be found of advantage to use two pieces of T-metal, or three or four pieces of angle metal riveted together; and these may be additionally strengthened by fitting in two or more of the angles with longitudinal segment pieces.

Fig. 1 is a side elevation of an anchor, the shank of which is constructed of two semi-circular plates, having a mid-feather running longitudinally through the centre of both shank and arms, the arms being formed of two pieces of angle or L-metal; Fig. 2 is a side view of the stock and upper end of the shank broken off.

Fig. 3 is a side elevation of an anchor, the shank of which may be constructed of two pieces of T-metal or four pieces of angle iron, having a mid-feather running the full length of the shank, and sufficiently broad at the lower end to form stays for the arms to which it is riveted.

CORADINE'S METAL CUTTING MACHINE.

The object of this invention, by Mr. T. Coradine, of Glasgow, is the cutting or dividing of metal or other sheets or plates into parallel strips or narrow portions, such as are required in many manufacturing operations, and comprises means for cutting two or more strips at once, and for altering or adjusting the parts, so as to give different widths.

Fig. 1, is a side elevation of the machine, partly in section; Fig. 2, is a transverse vertical section, and Fig. 3, is a face view of one of the cutting rings detached.

The framing of the machine consists of a pair of massive upright standards *A*, firmly connected together by tie rods *B*, and shaped to receive bearings *C*, for a pair of horizontal shafts *D*, arranged slightly apart vertically. The shafts *D* are provided with two or more pairs of cutting or shearing rings *E*, which are adjusted and held in position on the shafts by screw nuts *F*, fitted upon the shafts, which are formed with screw threads to receive them. The shafts *D* are geared together

CORADINE'S METAL CUTTING MACHINE.

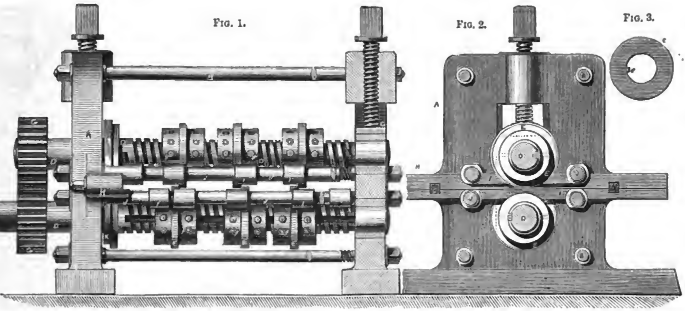


FIG. 1. FIG. 2. FIG. 3.

by means of the toothed wheels *G*, and are driven in any convenient way. The cutting rings *E*, which may be entirely of steel, or of iron with a steel or hardened cutting edge or rim, are keyed to the shafts *D* by tongues *e* (Fig. 3), which enter keyways, cut longitudinally through the screw threads of the shafts, and which do not interfere with the longitudinal adjustment of the nuts *F*. This contrivance prevents the cutting rings *E* from tending to unscrew the nuts *F*; but in order that these nuts may not be shaken loose by vibration or jarring, they are held in position by pinching screws *f*, tapped radially through them. Other holes are in the nuts, for inserting levers or turning instruments to adjust the nuts by. The cutting rings *E* are by preference formed with square, or nearly square, cutting edges as shown, and they are so disposed in the machine as to slightly pass each other's edges, the overlapping parts being in as close contact as possible. When the shafts *D* are revolving together, and the edge of a sheet is presented between the cutting rings *E*, the action of these is to draw the sheet through, cutting or splitting it up as it proceeds. At each cut one ring forces one edge of the cut upwards, whilst the other ring forces the other edge of the cut downwards; and it is important to observe that in order to prevent twisting of the strips, the pairs of cutting rings must be arranged alternately on opposite sides of each other as shown, this causing the sides of each strip to be pressed either both upwards or both downwards. If a metal or other sheet is to be cut into parallel strips, it is necessary to cut one of its edges straight in the ordinary way, and the sheet is entered into the machine with this straight edge edge against a guide *H*, fixed against one of the standards or *A*. In addition to this edge guide *H*, horizontal guides *I* are carried by rods *J*, extending from one standard to the other, and are applied at each pair of cutting rings *E*, for the purpose of directing the sheet horizontally in between the shafts, and to prevent the strips from bending or curling round the shafts on the delivery side after being cut. At the end of the machine at which the edge guide *H* is fixed there are fixed on the shafts *D* a pair of stepped rings *K*, which serve as stops in adjusting the nearest pair of cutting rings; but when two or more pairs of cutting rings are adjusted in alternately reversed positions as described, they act as stops to each other. The machine is represented as fitted with three pairs of cutting rings, whereby a sheet can be simultaneously cut up into three separate strips; the number of pairs of cutting rings may, however, obviously be modified to suit requirements, and similar or dissimilar widths may be cut at the same time, the cutting rings being easily adjusted to the sizes wanted.

Metal sheets of various thicknesses may be cut by this machine, and being made by it very equal in width and with very uniform square edges, the strips are peculiarly suitable for various purposes, such as the manufacture of metal tubes. A lighter modification of the machine may also be used with advantage for cutting card, pasteboard, and such like materials, into narrow strips for jacquard cards, or for tickets, for example.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

Address of JOHN HAWKSHAW, Esq., F.R.S., *President.*

ON Tuesday last, the new President of the Institution of Civil Engineers delivered an address. We have only room for the latter portion of it. The first portion of the address glanced at the progress of civil engineering for several years past, at the rapid advance of the railway system, steam navigation, and iron shipbuilding.

In grouping, said the President, engineering works, we may class the electric telegraph with railways and steamboats. All three are agents of intercommunication, and tend to the same important ends. And while the vast importance of each cannot be overrated, the electric telegraph is, perhaps, in the peculiarity of its operation, the most wonderful of all.

It was about the same time that the Liverpool and Manchester Railway was started that the minds of a few individuals were first devoted to the subject of using electricity as a medium of communication for messages.

Messrs. Cooke and Wheatstone's patents were taken out in 1837, but the first public telegraph was not established till 1839, when a communication was made by wire on the Great Western Railway between London and Slough.

Since that period, in this country alone, telegraphic communication has been extended over about 14,600 miles; in the rest of Europe, over about 100,000 miles; and in the American States, over about 48,000 miles; and the total extent of telegraph at this moment cannot be less than 200,000 miles.

On land, this most useful discovery has been uniformly successful. Like railways, it has grown (in England, by public support alone) into a great institution.

Ocean telegraphy has been less fortunate in its results. Short lines across the narrow seas have been laid and maintained, but at a serious amount of cost.

To some extent, no doubt, the failure of deep-sea telegraphs may be attributed to ill-conceived arrangements, and to faulty designs and workmanship; but the very nature of such an undertaking as laying telegraph wires across the Atlantic precludes the possibility of acting on previously-acquired experience, and makes the requisite experimental trial one of serious cost.

The labours of the late commission appointed to inquire into the subject have made the necessary scientific conditions for forming a good ocean cable better, and perhaps sufficiently understood. But they leave the ultimate cost of maintaining a permanent and available communication across three thousand miles of ocean (as, in fact, the great attendant contingencies compelled them to leave it) a question for the future to decide.

A communication with America once well established, would call for numerous wires. To meet contingencies, risk of accidents, and stoppages, a single cable would hardly be sufficient. With ample provision in these respects, a communication between the two countries could be maintained, but at a cost not at present admitting of calculation. There are some things physically practicable, but which in a commercial and monetary sense are for a while unattainable, and the accomplishment of this great object may therefore be delayed. It is to be hoped, however, that it will not be finally abandoned.

We are clothing our ships of war in iron mail, and it seems probable that iron in some cases will be largely used in modern fortifications. Not that earthwork and stonework will cease to be useful. These are valuable for the staple of most forts, but neither of them make good embrasures, and for that purpose iron offers great advantages. By its use greater strength can be secured at those points where power of resistance is specially wanted. By its use also the size, and consequently the exposure, of the embrasures will be diminished, and much greater facility be given for working the guns and training them through larger angles.

There are some cases, however, in which forts may with advantage be principally, if not wholly, built of iron. I hope to see that material adopted for the superstructure of the large sea-forts at Spithead, the construction of the foundations for which has been intrusted to me. There can, I think, be no insuperable difficulty in constructing iron forts so as to be impregnable to a ship's battery, though in the absence of knowledge as to what may be the ultimate powers of guns, it is not easy at present to arrive at safe conclusions. The difficulty of doing the converse of this, viz., of building ships so as to be impregnable to the fire of such artillery as may and ought to be placed in the new forts will be a problem not so easily solved.

No plated ship yet built could keep afloat under the fire of guns throwing shots of 200 to 300 lbs. weight, and it seems difficult, in the case of ships which require buoyancy, sufficiently to increase the thickness of their armour-plates to keep pace with the probable advance in weight and size of the new cannon.

Naval commanders rely a good deal, and perhaps up to a certain point correctly so, on the mobility of their ships; but ships cannot be so efficient if, to prevent being struck, they be always kept moving about. If never hit, they will of course receive no damage; but if ships are to resort to such manœuvres to avoid the enemy's fire, they do not seem adapted to bring great actions to a speedy conclusion. And how are such manœuvres to be managed with damaged rudders and disabled screws? Naval engagements will, in my opinion, be settled hereafter, much as they have been heretofore—the victory will be with the heaviest metal and greatest daring. And after the various discussions that have been raised on this point, fixed and floating batteries will be found each to have their uses; and it is, I think, a limited view of the question that leads to an undue exaltation of one over the other. If land batteries are, as some have urged, so innocuous to ships, why was Cronstadt not taken?

A very important question, viz., the use of iron for ships and forts, and war purposes generally, is now undergoing the investigation of a committee specially appointed for the purpose, and it is to be hoped that their labours will lead to some important conclusions.

As it respects the question of armour-plates, or of iron to be used for similar purposes, it would not seem that the hardest iron will prove the most suitable, unless it be combined with the greatest toughness. The force of impact is in a sense infinite. A ball cannot be arrested instanter in its flight. The thing struck, or the ball that strikes, must, one or both, possess some elasticity or ductility, or, if not, one or both must go to pieces. Of course, the object to attain, as it regards both ships and forts, will be to devise a structure that will best arrest the shot; but we have not yet arrived at the best mode of doing this.

The use of iron is extending on every side. Its manufacture is also, I am glad to say, improving. There was great room for its improvement. Several processes for converting it largely into steel, or into a metal approaching steel in character, are also now in use, and promise to afford an article at a moderate price double the strength of ordinary iron. These discoveries will tend still further to extend the use of iron.

Should it turn out that steel, or homogeneous iron as it is sometimes termed, uniform in quality, and of double the strength of ordinary iron, can be manufactured in large quantities at a moderate price, and can be easily manipulated; then, many things that are now with difficulty accomplished will be greatly facilitated, and some things which cannot be done at all will be rendered practicable.

Bridges of greater span could be constructed. Screw shafts, crank-axles, and other parts of steam-engines, at present of unwieldy size, would by its use be reduced to more moderate dimensions. There seems to be no limit to the size of guns, except that of the strength of the material, and the power of welding, forging, and handling them. Cannon, as we know, have already been greatly increased in power by adopting a superior material in their construction. Could we hit upon an inexpensive mode of doubling the strength of iron, the advantages to all sorts of machinery might be equal to those that would flow from the discovery of a new metal, more valuable than iron has hitherto been.

We are, I believe, in the infancy only of discoveries in the improvement of the manufacture of steel and iron. Until lately, the nature of the demand for iron rather retarded than encouraged improvements in its manufacture. Railways consumed iron in vast quantities, and railway companies cared nothing about quality. They were driven to seek a tolerably good material for engine and carriage tyres, but as it respected the vast consumption in the shape of rails, they were implicitly guided by the lowest prices. As long as this system continued, it suited the ironmasters to manufacture a cheap article in large quantities, and they therefore gave themselves no concern to establish a better state of things. But heavy engines, high speeds, and an enlarged traffic, are gradually working a change. We are beginning to find that iron of the very best quality has hardly endurance enough for rails or locomotive tires; that there is no economy in putting down rails which require taking up again in a year or two; and in short, that the increased strains arising from the accelerated motion of railways, steamboats, and machinery generally, are necessitating a better material.

In marine steam-engines, which have received much attention, and where great attempts have been made at perfection, paddle-shafts, crank-axles, screws, and other portions have, as before intimated, already attained an unwieldy size, and the *vis inertia* and weight of such masses of metal are of themselves no slight impediment to the improvement of steam navigation, and would be greatly obviated by the use of a stronger material.

Fortunately for this country, just at the time that the use of iron is extending, and improvements in its manufacture are developing, fresh discoveries are made of the raw material, and men seem to stumble, as it were by accident, on new fields of iron ore, in places where those mineral riches have laid dormant for centuries, to await a new era and another age, when ships, like knights of old, are to go forth to battle in complete armour, and when the civil engineer has assumed the duties which devolved on the smith and armourer of former times.

Having noticed some of the advantages that may flow from a greatly improved quality of iron, or a cheap manufacture of steel, or of a metal approaching steel in character, I may call attention to the great facilities that have arisen from the use of iron cylinders in sinking and securing foundations.

Before this invention, masonry built under water had to be performed by divers with helmets, or by means of diving-bells. That mode of construction does not admit of the best work. The stones are laid without mortar, and depend for their security on their large size, and on a good arrangement of bond.

It is true that concrete work (which, however, is inferior to masonry) could be built under water without either divers or diving-bells; by passing the concrete through the water to its destination in boxes or by means of shoots, and giving it the requisite form by casings of timber or iron.

This mode of building has been long adopted on the shores of the Mediterranean, and the docks and quay-walls at Genoa have been built in this manner.

But the use of iron cylinders not only admits of masonry or brickwork being built in mortar under water in any form, and with any bond, but enables the engineer to excavate under water and to examine the ground before he begins to build, and to proceed with his work with as much deliberation, method, and security, and almost with as little delay, when 70 or 80 feet below the water level, as he can do on dry land.

Hitherto this method has been mainly confined to the use of circular cylinders, sometimes used (as was done by Mr. Brunel in the case of the Saltash bridge) as a means of building the requisite pier of subaqueous masonry, the iron being afterwards taken away, and sometimes to enable the requisite piers of concrete, brickwork, and masonry, to be executed, and by allowing the iron cylinders to remain afterwards to protect the interior work.

In other cases, the cylinders themselves are used to support the incumbent weight, and then they act simply as piles.

But it appears to me that this method of building may be extended with advantage much farther than it has been. It is adapted to almost any form of pier, and might in certain cases be usefully applied in building continuous walls, and I know of no system that is likely to afford greater help to the engineer.

I have already said a few words on the progress of invention. This method of building is an illustration of the slow progress of really useful things.

In 1841 a patent was taken out for "improvements in the means of and in the apparatus for building and working under water," and soon after the construction of the Rochester bridge, where cylinders were sunk under air-pressure, an action was brought against Messrs. Fox and Henderson, the contractors for the bridge, for an infringement of that patent. I happened to be engaged on that trial, and the fact was then brought to light that many years before, the late Earl Dundonald (then Lord Cochrane), had taken out a patent for a similar purpose, very perfect in most of its details, for the drawings attached to Lord Cochrane's patent showed an air-lock almost identical with that now in use, and contained all the requisite arrangements for success. Lord Cochrane proposed to use it for overcoming difficulties similar to those encountered in the execution of such works as the Thames Tunnel; he proposed in fact to excavate such works under air-pressure.

This is another instance of the fertility of mind of that extraordinary man, who, great as he was as a sailor, would probably have been equally eminent as an engineer, and I here offer as a tribute to Lord Dundonald's memory this recognition of his early attempts to introduce the important system to which I have just been referring.

But we live in an age when men's minds turn to mechanical inquiries, and when probably they were never more fruitful in mechanical resources.

It is almost needless to give examples of this fact. The locomotive engine is a familiar instance, and railway machinery generally affords many illustrations. The beautiful cotton-combing machine, invented by Joshua Heilman, of Alsace, which was first used in the cotton manufactories to separate the fine from the coarse fibre, and has since been applied to wool, flax, and silk, and which acts almost with the delicacy of touch of the human fingers, is another illustration of this. Scheutz's calculating-machine is another remarkable instance, and many other cases might be named.

There is one subject, however, connected with mechanics which has hitherto been barren of result, about which men will occasionally occupy themselves, viz., the discovery of a new motive power.

The steam-engine, however, remains the only tame giant that is usefully subject to the will man.

The little that has been done in the way of its improvement, since it left the hands of Watt, speaks volumes to the sagacity, industry, and untiring perseverance of that great man.

The late Mr. Kennedy, of Ardwick House, who was on intimate terms of personal friendship with Watt, on one of his last visits to Soho, asked him if he had discovered anything new in the steam engine. "No," he replied, "I am devoting the remainder of my life to perfecting its details, and to ascertaining whether in any respect I am wrong." What the labours of that life produced we all know, and the patient concentration of will on his great object reminds one of Newton's similar labours in the perfection of his theory of gravitation, and evinces in the one case as in the other the truly great and philosophical mind, which is capable not only of discerning the dawnings of a great truth, and of appreciating its magnitude, but also of patiently pursuing its evidences until the whole is made clear as noon day.

At present it seems improbable, so long as motive power is to be obtained through the intervention of heat, and until a cheaper fuel than coal can be found, that the steam-engine will be superseded by any other machine.

Electric magnetic machines are perhaps the least likely of all inventions to supersede the steam-engine. The consumption of a grain of zinc, as Mr. Joule has shown, though much more costly than a grain of coal, does not produce more than one-eighth of the same mechanical effect.

It would not, however, be at all safe to predict that considerable improvements may not yet be made in the steam-engine, or in engines to be worked by coal.

The consumption of fuel in the best steam-engines has been reduced to 2½ pounds of coals per horse-power per hour; but such an engine does not utilise one-fifth part of the absolute mechanical value of the coal consumed, and so long as this is the case, it would be unwise to assume that we have attained the utmost limits of improvement.

BAROMETERS: THEIR CONSTRUCTION, USE, AND RECENT IMPROVEMENTS.

A Lecture delivered by Mr. R. STRACHAN, at the BRITISH HOROLOGICAL INSTITUTE.

(*Concluded from page 21.*)

It would occupy too much time to go into the philosophy of the action of the winds; those who wish to study it might consult, with much interest, a translation of Dove's work on the "Laws of Wind Gyration," by Admiral Fitz Roy. Suffice it to state, that in the southern hemisphere similar laws prevail; but there the points of the compass are altered, because the cold winds come from the south, the warm from the north. The S.E. wind in the southern hemisphere corresponds with the N.E. in the northern. The rule there is, while the wind veers from S.E., through E., N. to N.W. the barometer falls and the thermometer rises. When the wind veers from N.W. through W. and S. to S.E., the barometer rises, but the thermometer falls.

Admiral Fitz Roy caused a form of barometer, for the use of fishermen, to be constructed, the directions given in the scale of which are very practically useful, and are suited to the northern hemisphere generally, as well as around the British Isles. The scale words are as follows:—On one side, "RISE for north-easterly winds; that is for N.W. to N. and E.; *dry or less wind*:—Except wet from north-eastward." Underneath are the words

"Long foretold, long last,
Short notice, soon past."

On the other side the words are:—"FALL for south-westerly, that includes S.E., S., and W.; *wet or more* wind:—Except wet from th-eastward." The concluding words are:—

"First rise after l
Foretells stronger blow."

The exception in each case occurs with N.E. winds. The barometer may fall with north-easterly winds, but then they will be very violent and accompanied with rain, hail, or snow; again, it may rise with these winds accompanied with rain, when they are light with not much rain; however, it rises highest with the dry and light N.E. winds.

Such are the words on the scales of "Fishery" or "Coast" barometers. These instruments are very carefully constructed, and sent to various fishing places for the benefit of fishermen, in order that they may consult them before putting to sea. They are in use at forty or fifty fishing stations, placed there by the Board of Trade. The National Life Boat Institution has also sent similar to its stations. Their scale is not applicable for instruments intended for use all over the world, such as marine barometers. Admiral Fitz Roy, however, has arranged a suitable scale for them also. The scale for the northern hemisphere would be perfectly suitable for the southern, by simply changing the letters "N" into "S," or reading south for north, and *vice versa*. Then comparing and considering the words of the two scales, it would be perceived that for all *cold* winds the barometer rises, and falls for *warm* winds. The mercury also falls for increased strength of wind, if it continues in the same quarter; it rises as the wind lulls. Likewise, before or with rain the glass falls, and rises with fine dry weather.

Putting these facts together, and substituting for the points of the compass the terms "cold" and "warm," we readily understand Admiral Fitz Roy's scale on his marine barometer of which I have been speaking. It reads thus:—

RISE.	FALL.
FOR	FOR
COLD	WARM
DRY	WET
OR	OR
LESS	MORE
WIND.	WIND.
EXCEPT	EXCEPT
WET FROM	WET FROM
COLD SIDE.	COLD SIDE.

These scale words, then, are in perfect accordance to the laws deduced by Dove. There is nothing objectionable in them, and being founded upon experience, and the indications gathered from numerous records of the weather in all parts of the world, as well as confirmed by the deductions of science, may consequently be considered as generally reliable. They involve no conjecture, but express concisely scientific principles. These principles enabled Admiral Fitz Roy to foretell, a day or two beforehand, certain storms in the earlier part of this year. Government has carried out arrangements by which the state of the weather is telegraphed between London and the principal sea-ports. A system of signals is adopted, which gives warning to shipping, intimating the probable approach of dangerous winds and bad weather. So far as it has hitherto been carried out the plan has been quite successful, it appears. One of these intimations, in February last, was disregarded by a large fleet of colliers, and the consequence was that before morning more than half of them were wrecked.

Some captains would prefer a barometer in navigation to a chronometer, so highly do they estimate its importance. Others complain of it because they do not understand its indications. When a navigator arrived in the vicinity of Cape Horn, his barometer became a source of great perplexity to him, unless he had studied its nature sufficiently. Those captains who had done so, found in that very locality, the barometer (so much complained of there) a most valuable instrument. It has saved many ships and lives, and hundreds of thousands of pounds worth of property. By its indications, properly interpreted, the careful mariner is warned, and is enabled to take in sail and prepare for the coming storm. Dr. Arnott, in his splendid work on physics, stated that he was in a ship, the safety of which, and the preservation of the lives of all on board, he attributed entirely to the warning given by the barometer. It indicated an approaching typhoon; the captain accordingly took in sail, and he had scarcely done so when a most terrific gale came on, which, by the timely precautions taken, the ship was enabled to weather, and it could not have done so but for the barometer and the attention paid to it by the captain. The log of almost every ship tells a similar tale.

A very few words will suffice upon the *Aneroid*. In circumference, it is about the space of the bottom of an ordinary tumbler, and a little more than an inch thick, so that it is very portable, can be put in the pocket and carried about, hence will be very useful to fishermen, pilots, and travellers. The Aneroid before you is constructed by Messrs. Elliott Brothers. A description appeared in the "MECHANICS' MAGAZINE" in May last. Its peculiarity lies in its case. It can be shut up and protected from wet or accident, being intended especially for travelling. There is a little hook by which it can be suspended in a room, like the ordinary aneroid. Its indications can be read off, whenever they are wanted, by a simple movement of the top. A moveable part forms an index, by which it can be set, and from which is ascertained whether it has risen or fallen. The aneroid is a substitute for the barometer. It has to be graduated and adjusted by reference to a standard barometer, therefore it cannot be regarded as an independent instrument; however, if set correctly, it is in every respect as good as a barometer for a length of time. The patent for the aneroid has expired, hence we might expect them to be manufactured at a lower price; but further improvements will doubtless be made in them, and so improved they cannot be sold cheaply for some time.

The *Atmoscope* will interest you, because it brings the horological art into use for barometrical purposes. It is a self-registering barometer, on the syphon principle, being the ordinary "weather glass," very carefully made, with a clock and registering mechanism attached to it; and is called by Admiral Fitz Roy, "the Atmoscope." At certain periods, some clock mechanism comes down on the point of the indicator, and causes it to mark a paper moved along past the indicator at a certain rate per hour. On the paper the time is shown, as well as the height of the barometer. The instrument was first designed by Admiral Milne, and Admiral Fitz Roy writes of it thus:—"The atmoscope is found to be an exceedingly useful instrument. Its original design was invented by Admiral Milne, and though considerably modified since, as practice has suggested, in principle it is the same. It shows the alterations in tension or the *pulsations*, so to speak, of atmosphere on a large scale, by hourly marks, and the diagram expresses to a practised observer what the "indicator card" of a steam cylinder shows to a skilful engineer, or a stethoscope to a physician. It *may* be made to show its curve hourly, if required, by night and day for a week or more, but will be expensive proportionally to its subdivision and accuracy." The great value of this instrument is, that it will register for so long a time without attention.

Recently some very strange designs have been put forth for barometers. One is the invention of a gentleman named Mc Neild. The tube is made to float on the mercury in the cistern. It is filled with mercury, inverted in the usual manner, then allowed to float, being held vertically by glass friction points or guides. By this contrivance the ordinary range of the barometer is greatly increased. One inch rise or fall in the standard barometer may be represented by two or three inches in this instrument, so that it shows small variations in atmospheric pressure very distinctly. As the mercury falls in the tube with a decrease of pressure, the surface of the mercury in the cistern rises, and the floating tube rises also, which causes an additional descent in the column. With an increase of pressure, some mercury will leave the cistern and rise in the tube, while the tube itself will fall, and so cause an additional ascent of mercury. Another design has been introduced by Mr. Howson, on a principle directly opposite to the one just described. The tube is fixed, but its cistern is sustained by the mere pressure of the atmosphere. Looking at the instrument, it seems a perfect marvel. It appears as though the cistern with the mercury in it must fall to the ground. The bore of the tube is wide, about an inch across. A long glass rod is fixed to the bottom of the glass cistern, where a piece of cork or some elastic substance is also placed. The tube is filled with mercury, the glass rod is plunged into the tube as it is held downwards, until it gets close up to the cork and fits tightly against it. The pressure against the cork simply prevents the mercury coming out while the instrument is being inverted. When it is inverted, the mercury partly falls, and forms an ordinary barometer column. When the top is held, the cistern and glass rod, instead of falling away, remain perfectly suspended. There is no material support to the cistern, only the tube is fixed, the cistern hangs on to it. Glass is a great many times lighter than mercury. When the glass rod is introduced it displaces an equal volume of mercury. The glass rod, being so much lighter than mercury, floats and sustains the additional weight of the cistern, by its buoyancy. In the meantime, the atmosphere is acting upon the mercury, keeping up the ordinary barometrical column. Supposing there is a rise in the ordinary barometer, the pressure of the atmosphere drives some more mercury up the tube. This mercury is taken out of the cistern, which of course becomes lighter; when buoyancy carries it up a little higher, which also causes the column of mercury to rise still more. The increased pressure and buoyancy thus acting together, increase the ascent in the barometer column. One inch in the barometer might be represented by two or three inches in this instrument, according to construction. Supposing there was a decrease of pressure, the mercury would fall, come into the cistern, make it heavier, and increase the fall somewhat. Friction guides at the top of the rod prevent it coming into contact with the side of the tube when vertically suspended. These novelties have not been sufficiently tried to determine their practical value; but, as you have seen, they are far from the simplicity of the common barometer, therefore can never be so reliable, nor so accurately made.

In conclusion, let me add, there are various other improvements which might have been referred to. However, I have brought under your notice the chief improvements effected upon the original mode of construction. Perhaps, I may have given some information useful to some of the members of the Institute, because many persons engaged in the sale of horological instruments also sell meteorological instruments. Captains of ships generally expect to find that where they purchase a chronometer or send one to be rated, they should be able to get a good thermometer or barometer, aneroid, or sympiesometer. Although, therefore, members may not be engaged in the manufacture of them, it is well for them to be aware of the improvements introduced from time to time in their construction, principles, and mode of manufacture.

Mr. Cole, the chairman, in the name of the Institute, tendered the hearty thanks of its members to Mr. Strachan, for his able and valuable lecture.

MEETINGS FOR THE WEEK.

MON.—*London Inst.*, "On the Physics of Imponderable Matter," by Rev. A. Bath Power, M.A., at 7.

TUES.—*Inst. Civil Engineers*, I. Renewed Discussion "On the Discharge from Under-drainage." II. "On the Form and Materials for Iron-plated Ships, and the Points requiring attention in their construction," by J. D'A. Samuda, Esq., at 8 p.m.

Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., F.R.S., at 3 p.m.

WED.—*Geological Soc.*, I. "The Discovery of Flint Implements in Gravel near Bedford," by J. Wyatt, Esq. II. "On the Hyæna-den at Wookey Hole, near Wells," by W. B. Hawkins, Esq. III. "On the Drift containing Arctic Shells and other Fossils, near Wolverhampton," by Rev. W. Lister, F.G.S., at 8 p.m.

Society of Arts, "On the Improvements and Progress in Dyeing and Calico-Printing since 1851," by Dr. F. Crace Calvert, at 8 p.m.

London Inst., "On the Geological and Geographical Distribution of Organized Beings," by E. W. Brayley, Esq., at 7 p.m.

THUR.—*Royal Soc.*, at 8.30 p.m.

Antiquaries, at 8.30 p.m.

Royal Inst., "On Heat," by John Tyndall, Esq., at 3 p.m.

Linnean Soc., at 8 p.m.

FRI.—*Royal Inst.*, "On the Affinities and Differences between the Brain of Man, and the Brains of certain Animals," by Prof. Rolleston, M.D., at 9 p.m.

London Inst., "On the General Phenomena of Chymical Action, and the Laws which Govern them," by Henry Letheby, Esq., M.B., at 7 p.m.

SAT.—*Royal Inst.*, "On the English Language," by Rev. A. J. D. D'Orsey, B.D., at 3 p.m.

The National Rifle Association competitive trial of small bore rifles advertised to take place at Hythe early in February will, by permission, take place at the Government experimental ranges in Woolwich arsenal, where much greater facilities for such a competition can be afforded. All the rifles will be fired from the Government fixed rests, and each competitor will be furnished with a slide to which he will have himself to fit and fix his rifle in the way he thinks best. Drawings will at the same time be furnished of the mode in which rifles are fitted to the slides according to the plan now in operation at Woolwich, and likewise according to that adopted by Mr. Whitworth, competitors may, at any time previous to the trial, go to Woolwich Arsenal for the purpose of seeing that their rifles are properly fitted to the slides and rest, and in order to give ample time for this purpose, the trial will not take place until the end of February.

TO CORRESPONDENTS.

Received.—T. D., J. A., R. S., H. H. K., M. R., T M., J. H., a Constant Reader, J. C., J. W., B. S., T. G. S., Dr. P., R. D., Prof. R., Capt. B., Admiralty, J. G., W. W., W. and Co., S. Bros., W. and H.

W. S. S. Your suggestion for a Channel railway is worse than impracticable, it is foolish.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

THE CHANNEL RAILWAY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—As you may, very probably, have deemed my first letter, of the 2nd of last month, too long for insertion, and as my object was, and is, to record my ideas relative to this very important project, I beg sufficient space to state the principal points, so that I may, at all events, have the credit of my scheme, in the event of its hereafter being selected for adoption. Viz., that two small horizontal circular railway tunnels, be constructed (say of 15 feet diameter each), at a depth, as near as may be, of one hundred yards under the bed of the Channel, or one hundred and sixty yards below the surface of the sea, taking its greatest depth to be sixty yards.

These railway tunnels to be formed in solid rock, where practicable, and when of suitable quality, or of granite, or other stone of an equally durable nature.

Vertical pits or shafts to be sunk in the first instance to correspond with the termini of these tunnels, as affording facilities for the raising of materials, and of obtaining perfect ventilation during the progress of the works.

These submarine railway tunnels to be carried forward at suitable gradients, to a sufficient distance inland as to lead through the medium of open cutting to the surface, so as to admit of the formation (either in connection or otherwise with the present railways) of two separate and uninterrupted lines of railway communication between London and Paris.

The propulsion of the railway carriages through the tunnels to be effected by the pressure of atmospheric air, so applied as not to necessitate the stoppage of the trains previous to entering them.

I will only now add that I consider all structures of iron, whether in the shape of submarine railway tunnels or bridges, independent of all other difficulties and objections that might be argued against them, to be of much too perishable a nature for a work of this kind, which, when once completed, ought to endure for ages, without either renewal or reparation.

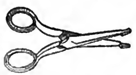
I am, Sir, respectfully, your obedient servant,

W. H. James, C.E.

Scientific Gossip.

Government Survey of the China Seas.—The serious inaccuracies of existing charts, and the losses of vessels navigating the China Seas caused thereby (of which H. M. troop ship Transit was one), has led Captain Washington, of the hydrographic department of the navy, to originate an expedition for the special purpose of a new survey. For this duty Commander A. J. Reed, has been selected, and under his direction H. M. screw steamer Rifleman has been equipped; six and a half years' previous employment on like work having made him well acquainted with the necessary requirements, and no ship has ever left our shores better adapted for such service. The Rifleman is furnished with Clifford's gear for lowering and disengaging boats.

Tempering Tools.—A correspondent in the *Scientific American*, in a letter on the best mode of tempering tools, says:—"By experience I have learned that the hardness of steel is due to the rapidity with which it is cooled. In cooling a piece of steel its size and its temperature must be taken into consideration, and the water or oil bath must be made up to suit the article. The steel face of an anvil can scarcely be made too hard; it therefore requires to be very suddenly cooled. A bath of salt water cools steel more rapidly than any other; fresh water is second to salt water. Oil and resin mixtures are made up to modify the time of cooling steel articles according to their size, and the purposes for which they are intended. With the tempering of saws I am but little acquainted, but the following I give upon personal experience. A thin steel instrument, such as a lancet, should be heated to a cherry-red colour, then plunged into oil having a temperature of 60° Fah. After this it is drawn (tempered) in the fire until it assumes a dark yellow colour. Penknives I treat I treat like lancets, but draw the colour to a light blue. Razors I treat like lancets, but plunge them into cold water at 60° Fah.; the temper is drawn to a light blue colour. Table knives are plunged in oil; the hardness is more drawn out than that for penknives; when they become black they are immediately cooled. Chisels and small tools for cutting wood I plunge in water like razors; but those of the largest size I plunge in oil at 60°. Those of small size I draw to a dark yellow colour. Light springs I immerse, like lancets, in oil, then hold them over a flame, when the oil takes fire. I draw out the hardness until they become black. I harden large springs by plunging them in water at blood-heat (100° Fah.), then oil them and blaze the oil until they become black. It requires experience to enable a person to temper a spring properly, because the colour is not a guide for it. Baths of sand and molten metal are used for tempering springs where great quantities are made. Swords receive a spring temper. Springs, swords, and other articles are polished after tempering, and are subsequently heated until they assume any desired colour."



Scissor Nippers.—Combined tools and instruments have of late years received more attention than formerly, and they are yet destined to receive more attention still. A single instrument, possessing more than one function, when equally simple in construction, is far more convenient than one which can only be used to perform a single operation. The accompanying engraving represents a pair of scissors patented by H. D. Walcott, Boston, Mass., with the points of the blades formed into nippers, thus combining a cutting and grasping instrument in one. For cutting cloth, pulling out the ends of thread in cloth, &c., its objects and aims will be readily understood.

How to Preserve Telegraph and Fence Posts.—A correspondent of an American paper says: "I wish to suggest an improvement in setting posts in order to preserve them. After the post is put in the ground, and the hole filled up to within fourteen inches of the top of the surface, then put about one-half a bushel of iron chips around the post and fill up with earth two inches above the chips. These chips will soon form a solid mass around the post, which will help to keep it firm and prevent it from rotting. Two hitching posts in front of my house were put into the ground, with iron chips around one while the other was put in as usual. I had occasion to take them up a few weeks ago and found the one with chips around it perfectly sound, while the other was entirely rotten. These chips can be got at any machine shop at a very little cost. It will take about thirteen bushels of them per mile for telegraph posts."

How to Preserve Potatoes at Sea.—Captain Gilbert Smith, of the barque Martha Wenzel, says, to preserve potatoes, put them into a pen on deck, the door of which must always be kept open in good weather, Scatter over them a quart of air-slacked lime to every twenty-five bushels; pick them and rub off the sprouts once every month. Put up and kept in this manner, they will remain good five or six months. On the 1st of August, 1861, he says:—"I have now potatoes on board that were taken in at Melbourne, January 20th; the vessel since has been to Callao, Chinchas, and is now within a few days' sail of Bourbon and Mauritius; consequently the potatoes have been on board, and daily used from, six months and ten days, and for cooking purposes they are as good now as when taken on board at Melbourne. Last voyage we took our sea stock of potatoes at Talcahuano, Chili, March 10th, arrived in London, July 5th, and sold off stock, leaving some three bushels for family use. I have eaten new potatoes that were grown on the old potato in the pen; the old potato sound, but the outside being shrivelled and shrunk, something like a dried prune or raisin. I merely mention these two cases as a proof of what I say, and can adduce more if wanted. I would further add in this matter, that if potatoes were taken out of the damp cellars in the spring and put in some dry outbuilding with a good circulation of air, and a little lime mixed with them, they could be kept until July and August in a good state of preservation."

Pneumatic Pile-bridge.—"Mr. C. C. Martin, the American engineer," says the *Illustrated London News*, "who completed the Brooklyn Waterworks, carried on the erection of a bridge across the Savannah River until interrupted by the civil war. This bridge is on the line of the Charleston and Savannah Railroad, about sixteen miles from the latter city. When completed, it will consist of six fixed spans and a swing-bridge, with an aggregate length of 900 feet. The two abutments and seven piers are to consist of pneumatic piles—the abutments and four piers to be of two piles each, the piers at the end of the swing-bridge to consist of four cylinders each, and the pivot-pier of five. The cylinders are cast in sections, nine feet in length, and six feet outside diameter, with two inches of metal. The apparatus for sinking these piles consists of a large flat boat, upon which is placed a 16-horse power steam-engine, and two double-acting air-pumps, hoisting apparatus, &c. In the *Journal of the Franklin Institute*, Philadelphia, appears an interesting account of the process of sinking the cylinders, with illustrative woodcuts. Two portions of cylinder are made air-tight by white-lead, and held in proper position by "guys," &c. The pumps are set in action, and the cylinder sinks into the sand (about six feet in three minutes) on the application of a vacuum. As the process proceeds, a syphon pipe, and other apparatus are employed. When at last a stopcock is opened, and the compressed air is allowed to escape suddenly, the upward pressure from within is removed, and the cylinder, by its own weight, forces itself deeply into the sand. The amount of sand which enters the cylinder under the bottom, when the pressure is allowed to escape, is astonishing. When a cylinder sank less than a foot, the sand rose inside it twenty-two feet (equal to twenty-one cubic yards), which was brought in by the rushing water in a few minutes. On one occasion, when the men were at work in a cylinder, they suddenly heard a sound like the report of a cannon, and all became as dark as night. The report was occasioned by the sudden removal of the pressure from without, while within the air was condensed. The darkness was occasioned by the rapid condensation of the vapour held in invisible suspension in the condensed air, forming a thick fog."

Royal Oak Armour Plates.—The *Times*, in speaking of the Royal Oak, now building in Chatham dockyard, says:—"The Admiralty have under consideration the invention of Mr. Scott Russell, whereby the plates can be fastened to the planking without any bolting whatever. It is, however, not yet decided whether their Lordships will avail themselves of the plan, which is stated to be not without its disadvantages. In order to test the merits of the invention before the final decision has been arrived at, a large target, intended to represent a portion of the side of the Royal Oak, is now being constructed at Chatham dockyard of balks of oak timber and teak planking. When completed, it will be covered with armour-plates, on Mr. Russell's plan, and tested at Shoeburyness with the Armstrong guns and the ordinary 68-pounders and 10-inch shot. Under the proposed system, the plates will be placed on the ship's side vertically, instead of being hung longitudinally. The contract for manufacturing the armour-plates for the Royal Oak has been taken by the Thames Iron Company. Each plate will be 15ft. in length by 3ft. 2in. in width, with an uniform thickness of 4½in., and a weight of four tons. The cost of each armour-plate will be about £120, exclusive of the additional cost of bending and fixing it to the side of the ship. The Royal Oak will be encased in armour-plates from stem to stern, and not, as is the case with the Defence and some other of our iron ships, only to within a certain distance on each side; by which means there will be no necessity for iron shotproof bulkheads, or compartments, in the interior of the ship. In order to strengthen her stern it is, we believe, intended to do away with the ordinary well-hole for lifting the screw, usually found on board screw steamers. At all events, directions have been received for a temporary suspension of the works at that part of the frigate until the decision of the Comptroller of the Navy is known on the subject. Should the proposal be adopted, the screw will only be capable of being raised while the ship is in harbour.

Bristol as a Port.—The *Bristol Mirror* publishes an article on the advantages of Bristol as an ocean mail packet station for the Atlantic steamers. Our contemporary says:—"If Bristol were selected as the port for the mail steamers, the same, or greater, despatch might have been obtained, without any very extraordinary exertions and with but one transhipment of the mail bags, at an enormous saving to the Government—not to mention the risks which are run in the frequent transshipments that occur by the present mode. For example, a delay of at least three-quarters of an hour is occasioned by the vessel running for Queenstown, instead of keeping on her passage as she would if steaming direct for Bristol; there are no less than seven transferences of the mail-bags—first, from the vessel to a boat or the railway for Cork; second, to a conveyance from Cork to

the railway station, for Dublin; third, from that conveyance to the Cork and Dublin Railway; fourth, to a conveyance from the Dublin to the Kingstown station; fifth, from that conveyance to the Kingstown railway; sixth, from the Kingstown station to the Holyhead steamer; seventh, from the steamboat to the railway at Holyhead for London. In all these cases the conveyances must be express, waiting for hours day and night, and there are 424 miles of railway express to perform, the cost of which has to be paid by the Government. Now, seeing that the Flora, belonging to the Bristol Steam Navigation Company, has frequently made the passage from Queenstown to Kingroad in sixteen hours, there can
e no doubt that the more powerful Cunard boats
ight reach Bristol in say, fourteen hours from the
oint off the entrance to Queenstown, and allowing
e Great Western express to travel at the same rate
s that between Holyhead and London, which could
ore easily be done on the broad than the narrow
uge, the whole distance to London might be accom-
shed (with but one transhipment and the saving
306 miles of railway expressing and all the other
enses of express boats, &c.), in about *sixteen
urs!*

Patents for Inventions.

RIDGED SPECIFICATIONS OF PATENTS.

abridged Specifications of Patents given below are
fied, according to the subjects to which the respective
tions refer, in the following table. By the system of
fication adopted, the numerical and chronological
of the specifications is preserved, and combined with
advantages of a division into classes. It should be
stood that these abridgments are prepared exclu-
for this Magazine from official copies supplied by the
ment, and are therefore the property of the propri-
this Magazine. Other papers are hereby warned
produce them without acknowledgment :—

Engines, &c., 1578, 1598, 1602, 1633.
s and their Furnaces, &c., 1588.
and Vehicles, including railway plant and car-
, saddlery and harness, &c., 1579, 1595, 1624, 1635,
nd Boats, including their fittings, 1614, 1621
tion of the Soil, including agricultural and hor-
ral implements and machines, 1589, 1628.
d Beverages, including apparatus for preparing
or men and animals, 1596.
Fabrics, including machinery for treating fibres,
aper, &c., 1575, 1583, 1597, 1599, 1615, 1618.
s and Building Materials, including sewers,
ipes, brick and tile machines, &c., 1582, 1607,
25.
, Heating, and Ventilating, 1581, 1586, 1592,
29, 1631.
e and Apparel, including household utensils,
pers, jewellery, musical instruments, &c., 1574,
3, 1587, 1589, 1590, 1591, 1594, 1600, 1604, 1606,
12, 1613, 1627, 1632, 1636, 1638, 1639, 1619, 1651,
cluding apparatus for their manufacture, 1622.
and Photography, 1611, 1619.
Apparatus, *None.*
None.
se Printing, &c., *None.*
ous, 1580, 1584, 1585, 1601, 1603, 1605, 1608,
1617.

lark. *Improvements in umbrellas and para-*
mmunication.) Dated June 19, 1861.
to arranging the whalebone and other frames
parasols, and sun shades, so as to turn freely
or stem. The principal feature consists in
mounting the turning-sockets, to which the
ached on the handles or stems. The inven-
scribed apart from the drawings. *Patent*

ken. *Glazing or calendering by steam,*
r power, textile fabrics, which have been
for use, or sewn together. Dated June 19,

s for carrying out this invention is attached
sverse beam or iron rod which is elevated
l ten feet or upward, and consists of an iron
about three feet and upwards in size, to
attached about three inches from the top.
what is called the glazing stick, and at
small iron case is made for inserting the
ich is to come in contact with the fabrics.
ed with holes, so as to adjust its sweep or
y one of those holes there is a horizontal
ich, in its turn, is connected with another
ever, and which being attached to a crank
ion by steam, horse, or water power, and
named upright lever with the pebble or
move backwards and forwards with any
and stroke it may be necessary to obtain.
to press against a wooden or iron cradle
verage worked by the foot, and between
pebble or stone the fabrics to be operated
are kept in their position by the person
paratus. *Patent abandoned.*

. *An improved clasp or fastener.* Dated

a method of constructing a clasp or
doors, boxes, cases, and articles in
red or closed without the use of a key.

1578. J. Paulding. *Improvements in locomotive engines.* Dated June 19, 1861.

This consists in so combining the mechanical parts of a locomotive engine that all the momentum resulting from the working of the various parts of the engine shall be on the longitudinal central line of the locomotive. To effect this object the patentee places the two cylinders of the locomotive at right angles to each other or thereabouts, and unites the connecting rods of each to one central crank pin on the driving axle. *Patent completed.*

1579. G. T. Bousfield. *Improvements in brakes for railroad cars.* (A communication.) Dated June 19, 1861.

The objects of this invention are as follow:—1. To render the pressure of the break standard—which is now sustained by the framework of the car—available for the purpose of forcing the break-shoes against the running wheels; also to render the breaks of the cars automatic in their operation, when the speed of the engine is slacked. 2. To enable the break mechanism of any car of a train to operate automatically, and apply the breaks whenever the speed of the next preceding car or carriage of the train is slacked. 3. To enable a thrust plate to be applied to each end of a car, and to permit but one only to act at a time, so that the breaks of a car may be operated automatically by the bumper of the preceding car, whichever end of the car be run forward, and that the succeeding car may not interfere with this operation. 4. To enable a brakesman to apply the breaks of all the wheels of that description of cars for street railroads in which the car body is raised end for end by turning it upon its truck, and in which the brake standard turns with the car body, whichever end of the car body be run foremost. 5. To enable the first part of the invention to be applied to four wheeled cars. *Patent completed.*

1580. J. F. Williams. *Improvements in compounds of india rubber and gutta percha with other substances.* Dated June 19, 1861.

This consists in combining with india rubber or gutta percha the black or dark residuum obtained when distilling palm and other vegetable oils by superheated steam. *Patent completed.*

1581. W. J. Harris. *Improvements in dry gas-meters.* (A communication.) Dated June 19, 1861.

The patentee claims the combination of a series of flexible diaphragms with a conical valve, having an inlet passage at one of its heads, an outlet passage at its other head, two lateral parts communicating respectively with the inlet and outlet passages, and turning in a conical valve-seat fitted with as many ports as there are chambers in the meter, the whole constructed, arranged, and operating as described. Also the combination of the said valve and valve-seat with an inclosed inlet passage or supplementary part in the valve, substantially as described. Also the combination of the stems of the flexible diaphragm with conical stopper seats. *Patent completed.*

1582. J. Cullen. *Improvements in preserving wood and iron.* Dated June 19, 1861.

Here a composition, consisting of coal tar, quick-lime, and charcoal, is used. The charcoal is reduced to a fine powder, and such is the case with the quick-lime; these materials are to be well mixed together and subjected to heat. To preserve wood, the composition is heated, and the wood is immersed therein. *Patent completed.*

1583. L. Hannart. *An improvement in the manufacture of gloves.* Dated June 20, 1861.

This consists in applying between two textile fabrics of any kind, a more or less thick adhesive coat of caoutchouc, purified and deprived of its unpleasant odours, so as to form a material appropriate to the manufacture of gloves. *Patent completed.*

1584. J. Fletcher and J. W. Fuller. *Certain improvements in machinery for planing, boring, and turning.* Dated June 20, 1861.

This consists in arrangements of mechanism whereby various articles are operated upon simultaneously. *Patent completed.*

1585. C. Stevens. *Improvements in spiral springs.* (A communication.) Dated June 20, 1861.

This spring, which is formed of tempered steel or other metal, is furnished with two sockets of different diameters, the smaller being able to pass in the spring, and serve as a guide. The other forms a shoulder, and serves as a prop to the spring. These sockets have a groove crossing them, in which the ends of two iron wire rods, bent at their lower extremities, rest. The openings thus arranged are placed where required, and instead of drawing on the two ends of the spring, so as to stretch it, the two ends of the spring are drawn on, but so as to compress it. *Patent abandoned.*

1586. M. F. A. T. de Menonville. *A new system of condensing and ventilation.* Dated June 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1587. H. Lawford. *Improvements in folding chairs, folding beds, folding arm-chair beds, folding couch-beds, and other articles for sitting, reclining, and lying upon.* Dated June 20, 1861.

This invention is not described in detail apart from the drawings. *Patent completed.*

1588. C. Stevens. *Improvements in smoke-consuming furnaces.* (A communication.) Dated June 20, 1861.

These furnaces are constructed with two grates placed opposite and beneath the boilers, and rectangular openings are made in the horizontal plan of the grates, allowing the divisions of the two fire boxes to communicate with a third compartment, which is situated between them, and in which the smoke is consumed. This third compartment is divided into other compartments corresponding with the openings made in the grates, the number of which must depend on the length of the grate. The small divisions perpendicular to the longitudinal axis of the furnace, and serving to separate the smoke consumer into compartments, are only about half the height of the space which separates the grate from the boilers, thus allowing a free space above by which the products of the combustion are conducted into the flue placed at the upper part of the fire bridge of the furnace. *Patent completed.*

1589. W. E. Gedge. *Improved means or apparatus for drying, sifting, and cleansing, grain and other agricultural produce.* (A communication.) Dated June 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1590. A. N. L. Lesueur. *A new system of crockery ware panels or of materials of the same kind.* Dated June 20, 1861.

Here the patentee forms the panels with two grooves or mortices cut in dove tail in the back of the panel. These grooves may be made transversely, vertically or otherwise, according to requirement. *Patent completed.*

1591. R. A. Brooman. *Improvements in pianofortes, parts of which improvements are applicable to other musical instruments and to apparatuses worked by pedals.* (A communication.) Dated June 20, 1861.

One of the great drawbacks to the perfection of the pianoforte as a musical instrument is the non-continuity of the sound, which, owing to the arrangement of the hammer, only lasts a stated time. To overcome this defect the inventor adds to the instrument an arrangement somewhat similar to the bow of a violin, which he causes to act separately or simultaneously with the hammer. To the intermittent percussive he adds a continuous action, and produces continuous sounds without in any way lessening the effects usually produced in pianofortes. *Patent completed.*

1592. C. Hodgson. *Improvements in the manufacture of fuel from peat, and in apparatus employed therein, parts of which are applicable to the moulding of bricks, tiles, and other like materials.* Dated June 20, 1861.

The patentee claims, 1. compressing peat, coal, or other material, to dry state without heating the same, as described. 2. Retaining a number of blocks under continued pressure in the same machine and at the same time for the purpose of completing their solidification, as described. 3. The construction and employment of a supplementary tube for the purpose of continuing, and at pleasure modifying, the pressure given to the blocks during manufacture, as described. *Patent completed.*

1593. C. Hodgson. *An improved method of partially drying peat before removing the same from the bog.* Dated June 20, 1861.

Having first cut drains in the portion of bog about to be used, in the ordinary manner and to such an extent as the local circumstances require, the patentee proceeds to clear off and remove the top rooty surface of the bog, leaving what is called by turf cutters "a clean floor." This, from the action of the drains, speedily becomes dry and tolerably solid, and as soon as it does so, he at once harrows up the surface to the depth of, say, from one to four inches, or to any required depth, with any convenient harrow drawn by animal or other power. He leaves the harrowed surface exposed to the air for a time, say from half a day to two days, according to the state of the weather, he then proceeds to collect and heap up the tolerably dry mull, which is the result of this process, by any convenient mode of scraping. *Patent completed.*

1594. J. H. Bartholt. *Improvements in the construction of children's nursery chairs, and in apparatus for use in combination with the same.* (A communication.) Dated June 20, 1861.

These nursery chairs consist of a framing with four upright posts supporting a cover or table, round the edges of which are arranged hanging curtains, the whole forming an ornamental canopy. The said chair is fitted with low sides, its back is hinged and adjustable, and can be set to any angle, or lowered to a horizontal position; it is fitted in front with a footboard, which is also adjustable. The seat, back, and sides of the said chair are stuffed in the ordinary manner. By using certain apparatus in combination with the chair, the same may be conveniently used as a baby-jumper. *Patent abandoned.*

1595. W. E. Marsily. *Improvements in velocipedes.* Dated June 20, 1861.

We cannot give space to the voluminous details of this invention. *Patent completed.*

1596. G. Turner. *Improvements in apparatus for beating eggs, and for mixing or agitating other fluids, compounds, or matters.* Dated June 21, 1861.

This consists in the use of a rectangular frame, which is caused to rotate within a suitable vessel, by certain toothed wheels. We cannot with advantage quote the details of the invention. *Patent abandoned.*

1597. J. S. Wright. *Improvements in reels or spools.* Dated June 21, 1861.

This consists, essentially, in certain methods of making reels or spools of papier mâché. *Patent abandoned.*

1598. J. Hannan and J. Hamilton. *Improvements in engine indicators.* Dated June 21, 1861.

This indicator is made with a spring, contrived so that the tendency to coil and uncoil is compensated for, so as to prevent the inaccurate indication which, in the instrument as ordinarily used, is caused by the increased friction due to the coiling and uncoiling action of the spring. *Patent abandoned.*

1599. T. R. Harding. *Improvements in the pointing of steel or other wire for teeth of cards, and in setting and fixing such or similar teeth into sheets or fillets, which improvements are applicable to the pins for hackles and gills, and in part to the pointing of needles.* Dated June 21, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1600. W. F. Henson. *Improvements in the manufacture of floorcloth, and in the means of ornamenting the same.* Dated June 21, 1861.

This consists in manufacturing floorcloth, &c., by the admixture of flock with the material known as kamptulicon, so as to produce a flock surface of the desired colour, and when required, to be ornamented with any particular design, pattern, or device. *Patent completed.*

1601. W. Hodson. *Improvements in steam hammers.* Dated June 21, 1861.

This invention consists in the substitution of a simple self-acting motion, and peculiar cylindrical valve for the complicated gearing generally in use. *Patent completed.*

1602. W. Hobson and T. Cavill. *An improved piston.* Dated June 21, 1861.

This invention consists in applying to engine pistons a resilient surface or packing capable of adjusting itself to the wear and tear of the cylinder. *Patent completed.*

1603. J. H. Johnson. *Improvements in the reproduction of forms of objects, applicable to the production of printing surfaces.* (A communication.) Dated June 21, 1861.

The essential feature of the new processes which constitute this invention is the employment of expansible and contractible plastic substances, such, for example, as gelatine, gluten, coagulated albumen, caoutchouc, and plastic substances used in the ceramic art, fibrine, and other substances of an analogous nature. *Patent completed.*

1604. A. L. le Harivel. *Improvements in the manufacture of papier-mâché, cardboard, and other similar articles.* Dated June 22, 1861.

This consists in certain novel arrangements of machinery for operating upon wood, in order, firstly, to convert the same into fibres and pulp; and secondly, to separate and assort the fibres according to their different degrees of fineness, preparatory to their being manufactured into paper, papier mâché, cardboard, &c. *Patent completed.*

1605. P. H. A. C. Safia. *Improvements in instruments for measuring angles and distances.* Dated June 22, 1861.

Here the inventor applies the indicator of the altridade, or of the telescope, in an eccentric way on a circular limit or dial plate; a second indicator or pointer works in a concentric way on the dial plate, and is concentric to the first indicator by an apparatus on its axis acting against the latter, so as to make the motion of both indicators dependent on each other, while the pointer or second indicator will mark on an amplified or multiplied scale (in the dial plate provided with curved lines circulated so as to mark suitable geometrical spots) the angle taken by the telescope or altridade. This principle of amplifying or multiplying the observed angle may be applied to an instrument for measuring distances. *Patent abandoned.*

1606. J. Church. *An improved stand or rest for pianofortes or other musical instruments.* Dated June 22, 1861.

Here the object is to increase the sound of pianofortes and other musical instruments, as harps, double bass, and others requiring to rest on the floor or other stand, and consists in a stand made of wood or other suitable material, into which stand is placed a spiral or any other form of spring made of steel suitably tempered, or any other convenient metal, and upon this spring is placed a cover made of brass, or other metal or material, suitably formed for the leg or castor of the piano or other instrument to rest on, and which for convenience is fixed firmly by a screw and nut, or other convenient means. These rests can then be placed one under each leg or castor of the instrument, as above mentioned. *Patent completed.*

1607. J. H. Johnson. *Improvements in the manufacture of floor tiles and paving blocks.* (A communication.) Dated June 22, 1861.

This relates to tiles or blocks for paving floors, and consists in manufacturing such tiles or paving blocks from a composition of hydraulic lime and sand, suitably prepared and pressed into the desired form by mechanical pressure. *Patent completed.*

1608. J. Comrie. *Improvements in churns.* Dated June 22, 1861.

Under one modification of this invention, the arrangement of the churn consists of two cast-iron standards, connected in the usual way by means of tie bars. The upper ends of these standards form the bearings for the axle of the churn or milkholder. The churn is made of wood, and is formed of an elliptical figure, which is arranged with its longer axis in the horizontal plane. This oval box is supported in the end standards by means of T shaped iron straps, which are screwed to the sides of the churn, and have laterally projecting studs which are supported in the forked ends of the standards. An opening is formed at the upper part of the churn to admit of access to its interior; and this aperture is fitted with a lid in the usual way. Parallel with the opening are fitted two handles, by means of which the churn is put in motion. Inside the churn are fitted three vertical partitions; these are perforated, and the central portion of each is made to slide up and down in grooves which are formed in the fixed side-pieces. When the churn is set in motion, the operator causes it to rock to and fro by means of the handles; with this oscillatory movement the milk falls to the lower part of the churn, and in its descent it passes through the perforations in the partitions, and is thereby very effectively churned. The manner in which the churn is suspended renders the labour of churning very light, and from the peculiar arrangement of the parts the time usually required is reduced. *Patent completed.*

1609. R. Ormerod. *Certain improvements in the manufacture of ornamental or fancy ribbons, and in the machinery or apparatus connected therewith.* Dated June 22, 1861.

This consists in printing patterns or devices in the form of ribbons, upon calico or other fabrics in the piece, by the well-known method of engraved cylinders, the cylinders being engraved with the required ribbon designs, and the colouring apparatus adapted as usual. When the entire piece is printed, the ribbons so produced are to be severed by an arrangement of cutters, and wound upon spools as ordinary ribbons, and are to be used for trimmings, &c. *Patent completed*

1610. R. Russell. *An improved valve to regulate the passage of fluids.* Dated June 22, 1861.

This invention embraces a valvular arrangement suitable for various purposes, whereby the flow of water is so directed that the pressure from the inlet is made available for shutting off the supply. A valve-seat is formed above the outlet in the valve-box or cylinder, and above the valve-seat in connection with the inlet, an orifice, the water-way of which is regulated by a wedge and screw; this orifice communicates with a water-port or channel which leads to a converge receptacle; beneath the outlet from the bottom of this receptacle there is a small water passage, which may be closed or opened at pleasure. To the spindle or valve-rod two valves are attached, one with the face towards the valve-seat above the outlet, and the other with the face towards the distant receptacle below the outlet. When the small water passage from the receptacle for the accumulation of water below the main outlet is open, the water passes away, and relieves the face of the lower valve from pressure; the water then acts with full force on the top valve, and depresses it below the main outlet, through which it flows uninterruptedly until the water passage communicating with the dished receptacle is again closed. The valves actuated by a ball and lever attached to the spindle or valve-rod are then raised, the water flows from the inlet through the port into the receptacle below the main outlet and, acting on the face of the lower valve, presses the top valve firmly on its seat, and thus effectually precludes the further flow of water. *Patent abandoned.*

1611. J. S. McArdle. *Improvements in the treatment of sea-weed, for the purpose of obtaining therefrom certain valuable products.* Dated June 22, 1861.

The sea-weed being freshly gathered on the coast, the first of the preliminary processes consists in washing it with water heated by steam, for the purpose of removing all saline matter, which, to some extent, retards the decomposition which takes place in the next stage of operations, which consists in piling the mass of washed sea-weed up into a heap, when, by means of the usual effects of heating, fermental decomposition takes place, and the bulk of the materials becomes reduced; during the heating process the mass of weed operated upon must be kept dry. At this stage of the operation the patentee now reduces the mass down, and obtains the salts therefrom, leaving the alkaline and saline matter unaffected; the organic matters which are generally attached to the crystals being removed by a slight charring. The water which is employed for washing, after repeated use, gets saturated, and he then evaporates it and obtains the crystals held in suspension. In order to obtain the ammonia, which exists to the extent of one and a half per cent. in sea-weed, he mixes the weed with a caustic alkali, preferably potash, or with an alkaline earth, lime, and subjects the mass to distillation. The alkali he recovers again in combination with the residual salts, which are unaffected by the process; and the hydrogen of a portion of the water, uniting with the azote or nitrogen of the sea-weed, passes off as ammonia, which is condensed by means of sulphuric or hydrochloric acid, forming sulphates or muriates of ammonia. *Patent completed.*

1612. J. and J. Cole. *An improvement in the construction of watches.* Dated June 22, 1861.

Here the object is to obtain, by a simple arrangement of driving gear, an independant dead centre seconds movement. In adapting the invention to an ordinary watch, the inventors mount an extra pinion of 20 teeth on an arbor that projects through the pillar plate. This pinion gears into the fourth wheel, and receives motion therefrom for driving the arbor which carries loosely at its upper end a second pinion of 20 teeth. This second pinion is made hollow, to receive a collect and spring, by which the pinion is secured to the arbor, so that, whereas the rotation of the arbor is continuous, that of the pinion may be intermittent. *Patent abandoned.*

1613. E. Dance. *A new or improved crinoline fastener.* Dated June 24, 1861.

This consists, essentially, of a flat metallic tube, in the interior of which the ends of the crinoline hoop are held by teeth or serrations situated within the tube. *Patent completed.*

1614. R. Moore. *Improvements in the construction, steering, and propelling of ships and other floating bodies, and appliances adapted thereto.* Dated June 24, 1861.

The first part of this invention is for constructing ships and other vessels, for which wholly or in part the inventor employs voluted plates, sheets, or strips of iron, and other suitable metal, or admixture of metal with other material of a plain or uniform surface, attached alone or in combination with other voluted or flatted sheets or strips, or with bar or angle iron, with or without filling or lining pieces, or in combination with cast iron or with timber, and also with or without other material, simple or compound, to maintain or increase the cohesion, compactness, or solidity of the metallic substances, or of all the component parts. The second part of the invention relates to the means of steering applied either as auxiliary to, or in substitution and independent of a rudder, and consists in the employment of two or more helical vanes placed in the forward or after cant body of the ship or other vessel, or in both. The plane of rotation of such vanes should be parallel or oblique to or upon the line of midship section of the vessel, and entirely independent of the action of the propeller, so far as propulsion is concerned. These vanes act laterally or sideways on the water at both sides of the ship, in a frame or transverse passage or opening (made watertight when necessary to prevent leakage in the ship), and are driven by any mechanical contrivance or motive power available for such purpose. The third part of the invention consists in the adaptation of one or more adjusting frames moveable in a vertical direction at the stern of ships propelled by helical paddles or screws of any kind whatever, for the purpose of permitting the propeller to be driven by direct shafting or by gearing, with variable immersion, irrespective of the ship's load line. The fourth part of the invention consists of an improvement in pumps, applicable to other purposes. In a cylindrical chamber with lateral openings communicating with a shaft, tube, or conduit, and rotating horizontally, a central cone acts on the water admitted, and transmits it to any level, or in any direction, operating either as a lift or force pump for any purpose for which it may be required. *Patent abandoned.*

1615. J. Farrabee. *Improvements in machines for fulling woollen and other fabrics, and in the method of driving the same.* Dated June 24, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1616. R. Hewson. *Improvements in barometers.* Dated June 24, 1861.

This consists in using a tube similar to that of the common straight barometer, except that, in the place of the centre bore of the tube being filled with mercury or other fluid, the central part of it is occupied by a light stalk or closed tube, leaving only a comparatively small concentric space for the mercury or other fluid; and instead of making the cistern for the surplus mercury or other fluid, fixed, it is attached to the said stalk or closed tube, so that the stalk cistern and fluid are held in suspension, and rendered free to rise or fall by every increase or decrease of pressure. The object is to add to the sensitiveness of the well-known Toricellian column, by giving it a comparatively increased range, or greater extent of rise and fall, also to obtain barometric readings on an extended scale, otherwise than from the top of the column. *Patent completed.*

1617. H. B. Barlow. *Improvements in knitting machinery.* (A communication.) Dated June 25, 1861.

The object here is to produce knitted fabrics of various widths by certain arrangements of self-acting machinery which are applicable to rectilinear and circular frames. It consists in the general arrangement of the whole of the parts, in the peculiar construction of some of the parts, and in the mechanism for actuating the jacks or sinkers, and parts in connection therewith, to form the stitches or meshes. The needles are stationary, but the jacks or sinkers, by which the thread or yarn is guided, are actuated to and fro and up and down by three cambars furnished with the requisite elevations and depressions. Another part consists in the mechanism for reducing the number of needles according to the width of the stocking &c., to be knitted. The narrowing is effected by a division wheel, to which one or more toothed segments are attached, and these segments act in combination with a vertical and two horizontal racks, which are in communication with the needles; or a compound sliding rack with suitable levers may be used in lieu of the division wheel above referred to. *Patent completed.*

1618. W. E. Gedge. *Improved means or apparatus for doubling and twisting the threads of any textile matter with any material susceptible of being carded or combed.* (A communication.) Dated June 25, 1861.

The object here is to utilize waste wool, and old woollens which have been carded afresh, but which cannot advantageously be again spun alone. This is effected as follows—To an ordinary throstle frame is adapted a cylinder carrying the material which has undergone the usual carding preparations, and a creel or bobbin holder on which is rolled the cotton or other threads intended to serve as standing warps for the materials it is desired to spin; the threads on the bobbin are so arranged that, in their rotation (which may be accelerated at will), they slightly graze or touch the carded material placed on the before-mentioned cylinder, so that these cotton threads cover or coat themselves with wool, and thus a thread or yarn is obtained the exterior of which is wool and the interior cotton. *Patent abandoned.*

1619. J. Lavon. *Improvements in the production of chromo-lithographic impressions upon glass, porcelain, and other similar material.* Dated June 25, 1861.

In carrying this invention into effect, all the parts of the drawing or design are first executed upon stone, exactly as they are to be reproduced upon bottles or other objects. The impression is taken dry upon coarse paper, sized, glazed, and previously coated on the side which is to receive the impression with a solution of gum arabic, or other very homogeneous gum or adhesive. On the gum side all the black of the design is first impressed; this black, which is the same as that used in lithography, is prepared for the operation in question with a varnish or glaze composed of alcohol and melted white resin. This impression in black is then powdered either with carmine, bronze, crimson, or other colour. The impression of the other colour is obtained by reversing the process of chromo-lithography upon paper, that is to say, which is to remain upon the paper; consequently, the last colour but one must be printed after the black, and in all cases immediately powdered with the desired colour, and so on to the end; but the third impression must, however always be gold or silver (in leaf or powder), and must entirely cover the preceding powdered colour. The fourth impression is taken in the same way, and must also cover all the design—in other words, all the colours must be covered with gold or silver. Further, all these colours must be printed with a transparent mordant. When the chromo proof has arrived at this point, to be enabled to counter-draw it on to the glass or other object, a new impression or ground must be made, completely covering the design; this ground is printed with a transparent mordant, composed of extra strong copal and white resin varnish. *The counter drawing.*—Immediately after the impression of the ground, the back of the paper is moistened with a sponge suitably soaked with water; this side of the proof is then placed upon damped paper, and when the humidity has sufficiently penetrated it, this proof is placed by hand directly on the glass or other object which is to be labelled with the design. The proof is first fixed by a slight rubbing with the palm of the hand, and an equal and sufficient pressure is then brought upon the entire surface by means of a roller covered with caoutchouc. The paper thus gummed or fixed to the glass or other object is again moistened with the sponge, and when it begins to crease or fold it is carefully withdrawn. The design is then allowed to dry for a moment, and the object is then washed with a fine sponge moistened with water to remove the preparations left by the gumming of the paper, and the excess of the mordant which has served in the impression of the colours, the gold, or the silver. The chromo-printing is thus provisionally ended, or there remains but to permit it to dry thoroughly upon the object; and when it is ascertained to be dry, the operation is finally completed by applying, with a very fine badger-hair brush, a coat of drying varnish composed of sugar or caramel and alcohol well rectified. *Patent completed.*

1620. L. PIERRE. *Improvements in the construction of iron windows or casements.* Dated June 25, 1861.

The inventor fixes the framing on the opening to be closed in a small rabbet on both sides, letting it in at the op, its two sides being adjusted to the sill. The sashes re fitted to the framing by plates or fastenings, which fit a to round rods intended to cover the joints. The two ides of the framing carry in their entire height a return small joint, which, penetrating into a dove-tail lined ith a band of caoutchouc, on which it presses, prevents ny air or water penetrating by the two sides. At the pper part of the framing, as also at the lower part of the l, is also fitted a dove-tail lined with caoutchouc, which, eiving a certain pressure by the fastening or bolt (the oks of which take into the rods), hermetically closes the ndow. *Patent abandoned.*

621. W. CLARK. *Improvements in apparatus for pro- ling vessels.* (A communication.) Dated June 25, 1861.

his invention consists of a wheel with floats or pallets unted at each side of a vessel. These wheels are sub- rged and placed horizontally in cavities made in the side he vessel, in such way that a third or fourth part only heir diameter projects and is uncovered. The cases aining the paddle wheels are placed within the plank- of the ship, which should be well caulked or constructed to prevent all ingress of water to the ship, and at time to receive the axes of the above-mentioned ls. The axes are, of course, necessary for the working e propellers, which should be disposed at the greatest lth of the vessel immersed, and placed below the ce of the water under the conditions mentioned. The llers should be disposed somewhat nearer the bow the stern; and, though placed lower or higher in the of the ship, they should always be disposed as expe- may suggest, and as best calculated for their action. the wheels are at rest, the water will completely and envelop the isolated cases and the wheels; but put in motion, the floats or boards of these wheels, g on the columns of water which surround them, will turbines, the one-half or more of which will be lized by the sides of the vessel, and the water con- in the cases will be compelled by their movement to without being able to again enter until the wheels gain still. To render the action more certain, the ceiving the wheel is itself encased in a second casing, a double envelope with the first, which permits of repaired and changed at will. *Patent completed.*

J. BROWN. *An improvement in the manufacture of* Dated June 25, 1861.

ocuments relating to this invention are with the ers, and cannot at present be seen.

F. WARRAN. *Improvements in the machine used sing cotton, and commonly called churka or roller* ted June 25, 1861.

rvention consists, first, in making both the rollers when desired. Secondly, in cutting spiral grooves ller, and rounding, or in any way blunting the such grooves, to prevent their cutting the fibre of . Thirdly, in pressing the one roller upon the en practicable, so as to produce raised lines upon roller that shall correspond to and work in the of the other. Fourthly, in using rollers with t lengthwise, and placing a piece of metal or able material in a position relative to the rollers, event the seed from being drawn through with the ould otherwise be the case when such rollers are thly, in grooving both rollers in any way desira- ly, in inserting material, other than that of rollers or either of them is made, into or on such the purpose of roughing the surface thereof. in placing the heads containing one pair or one s in each head on a suitable framework, and aft along in a proper position, having thereon ion wheels arranged to work in gear, or friction the rollers contained in the heads aforesaid, applying steam or other power to the the rollers are set in motion. Eighthly, a fast and loose pulley on one of the placing a shaft with suitable pullies any desired position, to be driven by er power, and by means of a band or strap haft to convey the power to the rollers. By ny one of the heads or sets of rollers can be easure, without interfering with the working the heads on the frame. Ninthly, in making s self-feeding. *Patent abandoned.*

EVENS. *An improved nose-band for stopping s.* (A communication.) Dated June 25, 1861.

nd or musrol consists of an open steel spring leather, and furnished with an oval shaped end, and is fitted just over the commence- ostrils of the horse; a strap is attached to e musrol, the other end of which is secured of the saddle, and on pulling this strap the nd the oval pieces press and seize the nostrils, breathing. *Patent completed.*

VENS. *An improved brick-making machine.* lon.) Dated June 25, 1861.

n is not described apart from the drawings. d.

x. *Improvements in machinery for pre- ning flax or other fibrous matters.* Dated

n consists, firstly, in dividing and spreading ly by a machine which the patentee calls a . Secondly, in the application in duplicate screw gill arrangement to the first pre- e, the object being to do away with the which condense the flax thereon. The aving been laid by the divider-spreader, een condensed, is conducted between two The drawing operation will therefore be breaking or injuring the flax, as it is e pins or gills. Thirdly, in the application of a second drawing roller to the said machine, in order to extend over two points the enormous pressure exerted upon the flax. By this means a portion of the waste pressure is utilized. Fourthly, in the application of a fixed pinion upon the drawing cylinder, made to gear into a wheel which is mounted fast upon the shaft upon which the wooden pressing rollers are mounted, so that the working of these latter will be regular, and never stopped by the resistance which might be offered by the flax. This method possesses the advantage of still further diminishing the pressure exerted upon the matter operated upon for the drawing operation. Fifthly, in the machine for spinning flax in the half wet state of different lengths, the improvement consists in the inclination to be given to the strick, according to the fineness of thread required to be obtained. In any case the ends of the stricks of flax rub constantly against the drawing cylinder until they are taken hold of between the pressing rollers. The machine is so constructed as to give these various inclinations. *Patent completed.*

1627. J. BROWN. *Improvements in window frames and blinds.* Dated June 25, 1861.

For the purposes of this invention, in order more advantageously to employ wire gauze or perforated blinds, for the purpose of ventilation, the upper part or arch of the opening for a window frame is cut away, if already built, in order to receive an air or perforated block in the form of a key stone, but in new buildings such arch head is to have a perforated block in stone, brick, or iron, with curves at the back of the same introduced in the arch when constructing it. The upper part of the window frame is enclosed above the top of the upper sash, so that there is a hollow chamber at the upper part of the window frame into which air can readily enter from the external air through the perforated block in the arch. In the interior of the room there are one or more openings or air passages into this hollow chamber, which are covered with wire gauze or perforated metal, by which air may pass from the chamber above the sashes to the room, or from the room to the outer atmosphere. *Patent abandoned.*

1628. J. FOWLER. *Improvements in machines for ploughing or tilling land by steam-power.* Dated June 25, 1861.

In ploughing or tilling land by steam-power it is common to mount the pullies round which the hauling rope passes on carriages carried by disc wheels, which cut into the land and thus prevent the carriage being drawn sideways by the strain on the rope, but allow of its travelling endways with considerable facility. In some cases, also, in place of disc wheels metal plates or shares, also cutting into the land, have been employed; the pulley carriages, thus arranged, can only with facility be made to travel forward in a straight line. According to this invention, the patentee so arranges the disc wheels or coulters that they may be set at an inclination to the carriage, either to the one side or to the other, so as to cause the carriage to travel in any required direction. This power of steering the pulley carriage is very necessary when the headland along which it is required to travel is curved. *Patent completed.*

1629. S. WENTON. *Improvements in ventilating apparatus.* Dated June 26, 1861.

This relates particularly to the mode of arranging and giving motion to a series of what are technically termed louvre or buffer boards, or flat strips or pieces of wood, metal, glass, or other material, enclosed in a frame, and capable of being placed at any angle, so as to be capable of opening or closing the apertures in which they are placed to any extent desired. *Patent completed.*

1630. W. HOLLAND. *An improvement or improvements in suspending, and raising, and lowering window sashes.* Dated June 26, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1631. J. REDFERN. *Improved apparatus for raising the temperature of air in order to warm churches, conservatories, houses, and other buildings or places.* Dated June 26 1861.

The inventor proposes fixing a fire-grate on the centre of a circular plate. This plate will have attached to it an ash-box with register door, and a cylinder with fire door will be placed upon it, such cylinder having an open top, on which he proposes fitting a syphon tube, connecting this first-named cylinder with a second cylinder, placed in a second circular plate, to which plate will be attached a flue to carry off the gases from the fire to the chimney. The above-named parts of apparatus may be made of iron or other material. *Patent abandoned.*

1632. E. A. LINOARD. *Improvements in fastenings for jewellery or other articles.* Dated June 26, 1861.

This invention consists in the adaptation of one or more bars of gold or other metal, or other suitable material, (which bars may or may not be hollow, in the form of tubes or otherwise), the said bars being so fixed to a bridge, span, or bow of metal or other material, as to leave an aperture to admit the article or articles to which it is desired to attach the fastener, and inside or outside of the said bars it is intended that a bolt or bolts should work or slide, so as to close the said aperture, and which bolt or bolts, or slide or slides may be fitted with or without propelling or retaining springs; or, for greater security, may have a securing or locking action applied thereto. *Patent abandoned.*

1633. M. A. F. MENNONS. *A new or improved construction of caloric engines.* (A communication.) Dated June 26, 1861.

This invention consists in a new or improved combination of known machinery applied to the construction of locomotive, stationary, marine, and other engines. The essential elements of this combination, in which heated air is the motive agent, are:—1. A ventilating apparatus, by means of which cold air is thrown into the body of the engine. 2. A furnace, composed of a metallic cylinder, provided with a horizontal grate carrying the fuel, with vertical grated apertures, giving passage to the air supplied by the ventilator. 3. A turbine, mounted on a horizontal shaft, and driven by the dilated air mingled with the gaseous products of the combustion. 4. A regenerating apparatus, by means of which the cold air supplied by ventilator is progressively heated to a given point, while the temperature of the hot air escaping from the turbine is reduced in the same proportion. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Nov. 18, 1861.

2899. A. J. Mundella, Nottingham, manufacturer, and W. Onion, mechanic. Improvements in machinery or apparatus for the manufacture of looped fabrics.

Dated Nov. 20, 1861.

2917. F. Puls, 25 Francis Terrace, Hackney Wick, chemist. Improvements in treating fatty or oily matters.

Dated Nov. 27, 1861.

2981. P. F. Dumarchey, Boulevart de Strasbourg, Paris, engineer. Improvements in machines for crushing and pounding stones, ore, and other materials.

Dated Dec. 3, 1861.

3027. A. M. A. Plehery and P. L. Danais, Nantes, France. Improvements in hermetically stoppering or covering jars, pots, vases, and other like articles.

Dated Dec. 7, 1861.

3067. T. Lawes, 63 City-road. Improvements in the manufacture of quilts and coverlets.

3076. B. W. Gerland, Newton-le-Willows, Lancaster, chemist. Improvements in the manufacture of sulphate of copper and other salts of the same metal.

Dated Dec. 13, 1861.

3123. S. B. Hewett, Railway-Cottage, Fairfield-road, Bow, engineer. Improvements in the construction of boilers or generators for steam engines and other uses, applicable also to evaporators, and in pumps used therewith or otherwise used, some of which improvements in pumps are applicable to pistons and piston rods generally.

3129. J. W. Friend, Freemantle, Southampton. Improvements in apparatus for registering the depth and flow of liquids, and the distances run by ships at sea.

3131. T. B. Gibson, Glasgow, manufacturer. A new or improved method of ornamenting certain fabrics.

3132. S. Padley, Swansea, Esquire. Improvements in paddle wheels.

3133. P. Quantin, Bouscat, near Bordeaux, France. Manufacturing moulded earthen or stoneware cross-sleepers, for superseding wooden ones in the construction of railways.

3140. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in and apparatus for the production and application of motive power in locomotive and other steam engines. (A communication.)

Dated Nov. 14, 1861.

3142. E. C. B. de Beaulieu, Avallon, Yonne, France. Improvements in apparatus for extracting gold dust from auriferous sands.

3143. C. McDougall and J. Crane, Manchester, wholesale warehousemen. Improvements in raising and supporting ladies' dresses.

3150. E. Cajot, merchant, St. Servais, Belgium. Improvements in the treatment of pyrites for the manufacture of iron.

Dated Dec. 17, 1861.

3159. W. H. Tucker, 181 Fleet-street. Improvements in locks.

Dated Dec. 18, 1861.

3167. S. Sheppard, Birmingham, manufacturer. A new or improved tap or stop-cock.

3169. M. Cartwright, Carlisle, dentist. Improvements in the manufacture of beds or palates for the reception of artificial teeth.

3173. J. Piddington, 52 Gracechurch-street. Improved condensing apparatus for steam engines. (A communication.)

3179. C. Pontifex, Shoe-lane, coppersmith and vat maker. Improvements in refrigerators for cooling worts or other liquors.

Dated Dec. 19, 1861.

3181. T. Bourne, New York, U.S. Improvements in cotton gins. (A communication.)

Dated Dec. 20, 1861.

3186. W. Makin, Attercliffe, Sheffield, steel manufacturer. Improvements in apparatus for the manufacture of cast steel mill chisels, and other taper tools and files.

3187. J. Standfield, Aylsford, and J. Standfield, Stratford, Essex, engineers. Improvements in machinery or apparatus for giving motion to ships and machinery, and for raising water

3189. C. E. Wilson, Monkwell-street, Falcon-square. Improvements in collars for gentlemen's, ladies', and children's wear.

3191. J. Westwood, London-yard, Poplar, shipbuilder. An improvement in the construction of hydraulic pipes.

3193. G. Walkland, Saint Pierre-les-Calais, lace manufacturer. An improved machine for winding lace or other similar fabrics or tissues on cards or other materials.

3194. W Tipple, Clarence-place, Gravesend. Improvements in paddle wheels for the propulsion of ships and other navigable vessels.

31 5. V. d'Almeida, Nottingham-street, Marylebone. An improved mode of obtaining colouring matter, applicable to dyeing skins, silk, wool, and other fibrous materials. (A communication.)

3198. R. A. Brooman, 166 Fleet-street, patent agent. A new improved method of preparing silk fabrics, to be employed in the manufacture of hats, caps, and bonnets. (A communication.)

3200. R. Wailes, Brighton, doctor of medicine. An improved tool or apparatus for cleaning windows and glasses.

3201. T. Green, Smithfield Iron Works, Leeds, W. Green, 11 Brunswick-place, Leeds, and R. Mathers, Trafalgar-street, Leeds. Improvements in lawn mowing, rolling, and collecting machines.

Dated Dec. 21, 1861.

3204. J. Wakefield, Birmingham, machinist. Improvements in sewing machines.

3209. W. L. and W. Allchin, Globe Works, Northampton, engineers. Improvements in apparatus applicable to the superheating of steam.

3211. F. Selby, Surbiton, engineer. Improvements in boilers for the generation of steam in engines, foe applying steam for motive power purposes, and in wheels and ways for steam carriages to run on.

3212. W. Kempe, Holbeck Mills, Leeds. Improvements in scrays or tables, applicable to gig mills, brushing mills, and other like machinery.

3213. C. Osman, Chryssell-road, Brixton. Improvements in the manufacture and application of elastic or yielding surfaces, for sitting, lying, or reclining upon.

Dated Dec. 24, 1861.

3214. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in apparatus for cleaning wheat and other grain. (A communication.)

3215. L. R. Bodmer, 2 Thavies-inn, Holborn. Improvements in looms for the manufacture of sacks, knapsacks, mattress cases, and other goods. (A communication.)

3217. J. Rosindell, Mile-end, brewer. An improved method of and apparatus for separating solid from liquid substances.

3219. E. Ede, 7 Abercorn-mews, Violet-hill, St. John's-wood, smith and farrier. Improvements in the construction of horse shoes.

3220. J. P. Harvey, 145 Strand, manufacturer. Improvements in umbrellas and parasols.

3223. E. B. Sampson, Ham Mills, Stroud, Gloucester. Improvements in apparatus for drying wool and other fibres and substances.

3224. J. B. Wood, Broughton, near Manchester, M.D. Improvements in the manufacture of driving straps or bands, the backs of wire cards, and cop tubes.

3225. F. Laurent and J. Casthelaz, 19 Rue Ste. Croix de la Bretonnerie, Paris, chemists. Improvements in the manufacture of colouring matters.

3226. J. Cochrane, Woodside Iron Works, Dudley, engineer and ironfounder. Improvements in apparatus employed in sinking cylinders and open coffers for forming foundations under water.

3227. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in the arrangement of traction and connecting apparatus for railway carriages and trains. (A Communication.)

Dated Dec. 26, 1861.

3230. T. Standing, Preston, ironmonger. Improvements in cinder sifters and ash receptacles, applicable to domestic fire grates.

3232. J. Schloss, Cannon-street, City, merchant. Improvements in envelopes for containing photographic portraits and pictures. (A communication.)

3234. J. Shepherd, Manchester, engineer. Improvements in apparatus for cleansing steam boilers.

3235. R. Needham, Dukinfield, Chester, engineer. Improvements in apparatus for cleansing steam boilers and lubricating the pistons of steam engines, and for an improved steam trap.

3237. J. N. Palmer, Fenchurch-street. Improvements in cooking stoves and ships' ranges. (A communication.)

Dated Dec. 27, 1861.

3238. W. Hawksworth, Oldham, machine maker. Certain improvements in carding engines.

3239. T. Silver, Philadelphia, U.S., gentleman. Improvements in apparatus for governing or regulating the speed of steam and other engines.

3242. T. Bright, Old Foundry, Carmarthen. Improvements in machinery for cutting hay, straw, and other vegetable substances.

3241 W. E. Newton, 66 Chancery-lane, C.E. Improvements in steam generators. (A communication.)

3245. J. McIntyre, New York, U.S. Improvements in bomb shells and similar projectiles.

3247. J. J. H. Fajole, Courbevoie, French empire, gentleman, and P. A. Agostini, doctor of medicine. An improved composition or improved compositions, suitable for painting, varnishing, and coating.

Dated Dec. 28, 1861.

3248. J. W. Harland, Chorlton-on-Medlock, Manchester, artist and engraver on wood. An improvement or improvements in the manufacture of wood and other types or substitutes therefor or furniture used by letter-press printers.

3249. E. Lord, Todmorden, York, machine maker. Certain improvements in machinery for preparing cotton and other fibrous substances.

Dated Dec. 30, 1861.

3252. J. P. Dormay, Wandsworth, Surrey, J. S. Aikenhead, boat builder, and T. Johnson, boat builder. Improvements in the construction of boats for sailing or rowing.

3253. J. Edwards, 77 Aldermanbury. Improvements in the permanent way of railways.

3256. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in apparatus for raising or forcing water or other fluids. (A communication.)

3257. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the manufacture of cube sugar. (A communication.)

3259. A. I. Austen, Millwall, candle manufacturer. Improvements in the manufacture of night lights.

Dated Dec. 31, 1861.

3261. A. Macnair, 34 Southampton-buildings, Chancery-lane. Improvements in axle boxes for railway carriages. (A communication.)

3263. T. and W. Green, Smithfield Iron Works, Leeds, and R. Mathers, Trafalgar-street, Leeds, engineer. Improvements in chains for giving motion to chain wheels, and in giving motion to machinery.

3267. W. Spence, 50 Chancery-lane. Improvements in deflectors for lamps. (A communication.)

3269. W. H. Bailey, Salford, turret clock maker. Certain improvements in sewing machines.

3271. W. E. Newton, 66 Chancery-lane, C.E. Improved apparatus for boring rocks and other mineral substances. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

36. G. T. Bousfield, Loughborough-park, Brixton. Certain new and useful improvements in machinery for propelling water craft. (A communication.) Dated Jan. 4, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2190. A. N. Saleres. Printing and colouring paper, chintz, and other fabrics.
2196. F. Robertson. Manufacture of ammoniacal salts.
2208. C. Edkins. Ladies' dress suspenders.
2209. J. E. Ridges and J. Barker. Carriages.
2210. D. and J. Heyworth. Looms for weaving.
2210. C. W. Harrison. Casters.
2223. M. A. F. Mennons. Ribbon looms. (A communication.)
2224. M. A. F. Mennons. Motive power. (A communication.)
2255. W. Spence. Dividing and softening vegetable fibres. (A communication.)
2229. C. F. Kirkman. Obtaining manure from sewerage.
2231. J. Brown. Looms.
2237. W. Ainsworth, E. Heap, W. Fielding, and E. Openshaw. Looms.
2238. N. D. P. Maillard. Making potash, pearlash, and caustic potash of commerce.
2239. J. Carpendale and T. Middleton. Producing chasing on metal.
2241. J. Holland and G. Okell. Railway signal.
2245. G. Malcolm. Treating fibrous substances.
2246. W. Simons. Ships or vessels.
2250. J. H. Johnson. Fire grates and furnaces. (A communication.)
2255. J. Anthony. Steam boilers and generators.
2258. L. P. Barre. Tubular steam boilers.
2260. W. L. Thomas. Projectiles.
2262. G. H. Birkbeck. Needles. (A communication.)
2275. P. Dubrule. Manufacturing figured or ornamental stuffs.
2278. R. Fell. Compressing and rarefying atmospheric air.
2280. T. L. Murray. Application of mica for letters and signs. (A communication.)
2281. J. B. Howell. Chains and chain cables.
2286. J. A. Knight. Rendering and delivering fatty or oleaginous matter. (A communication.)
2291. J. King and J. Sutcliffe. Spinning and doubling.
2308. W. Stewart. Enabling persons to progress through the water.
2314. J. Graham. Force or lift pump.
2357. W. G. Creamer. Railway breaks.
2380. A. J. Sedley. Bridges and viaducts.
2388. C. G. Lenk. Pens.
2423. W. N. Wilson. Sewing machines.
2466. T. Warwick. Umbrellas and parasols. (Partly a communication.)
2476. E. T. Hughes. Permanent way of railways. (A communication.)
2522. F. Curtis. Fire-arms.
2610. H. B. Fox. Metallic bedsteads.
2745. M. and M. Myers and W. Hill. Clips or joints.
2800. W. A. Shepard. Treating gutta percha and india-rubber.
2848. J. Hodgkinson and D. Greenhalgh. Preparing cotton materials to be spun.
2902. J. Hemingway. Apparatus used in the working, "winning," or mining of minerals or earthy matters.
2961. A. V. Newton. Removing and preventing the formation of calcareous and saline deposits in steam boilers. (A communication.)
2997. H. Wilde. Magneto-electric telegraphs.
3047. A. T. Carr. Preventing horses slipping.
3142. E. C. B. de Beaulieu. Extracting gold dust from auriferous sands.
3148. W. Husband. Water safety valve.
3151. W. Bartram and W. S. Harwood. Filling and ramming cartridges.
3159. W. H. Tucker. Locks.
3201. T. Green, W. Green, and R. Mathers. Mowing, rolling, and collecting machines.
3225. F. Laurent and J. Casthelaz. Colouring matters.
36. G. T. Bousfield. Propelling water craft. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Jan. 11, 1862.

1767. T. Smith and G. Taylor.
1772. T. Cobley.
1773. T. Cobley.
1774. R. Taylor & T. Price.
1775. J. C. Coombe and J. Wright.
1776. T. Cobley.
1777. B. Browne.
1779. J. H. Johnson.
1788. J. Blinkhorn.
1789. R. Jones.
1793. W. Palmer.
1807. B. Johnson and W. H. Anderson.
1810. P. Williams and T. Parkinson.
1814. J. W. Rogers.
1816. D. Gallafent.
1818. P. Shaw.
1819. R. Laing and G. H. Cossins.
1820. R. C. Newbery.
1824. R. A. Brooman.
1834. M. Henry.

Sealed Jan. 14, 1862.

1795. J. H. Butterworth.
1796. J. H. Butterworth.
1826. W. E. Newton.
1827. E. T. Hughes.
1838. J. B. Wood.
1839. W. Wood.
1846. R. Thompson.
1858. A. Wood.
1871. C. Robertson.
1921. J. E. Drouot.
1932. P. O'Hanlon.
1967. L. W. Viollier.
2031. J. Bethell.
2073. T. Sutton.
2093. W. Richards.
2335. J. C. Coombe and J. Wright.
2338. G. T. Bousfield.
2360. G. T. Bousfield.
2379. W. E. Wiley.
2535. A. V. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

69. J. T. Forster.
74. T. J. Claxton.
80. C. M. Kernot.
81. J. Biers.
88. F. Versmann and A. Oppenheim.
89. N. P. Burgh.
95. J. Gibbons.
98. W. and W. McNaught.
103. C. Beslay.
108. H. Critchley and S. Elston.
113. J. J. Stevens.
114. F. J. Manceaux and E. N. Vieillard.
121. T. Sampson.
126. J. Dauglish.
132. R. Musbet.
141. W. E. Newton.
198. B. Lauth.

PATENT ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

72. A. Robertson.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Jan. 11, 1862.

No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr s	Pr d	No.	Pr s	Pr d
1277	0	3	1358	1	10	1370	0	7	1382	0	5	1391	0	9	1406	0	3
1347	0	6	1359	0	9	1371	0	10	1383	0	3	1395	0	6	1407	0	3
1348	0	3	1360	0	8	1372	0	1	1384	0	3	1396	0	3	1408	1	4
1349	0	3	1361	0	8	1373	0	3	1385	0	8	1397	0	10	1409	0	10
1350	1	2	1362	0	6	1374	0	9	1386	1	10	1398	0	3	1410	0	3
1351	0	6	1363	0	5	1375	0	7	1387	0	4	1399	0	7	1411	0	4
1352	0	7	304	0	3	1376	0	3	1388	0	10	1400	0	6	1412	0	3
1353	0	4	1365	0	3	1377	0	3	1389	0	10	1401	0	3	1413	0	3
1354	0	10	1366	0	11	1378	1	11	1390	0	3	1402	1	4	1414	0	3
1355	0	7	1367	0	3	1379	1	4	1391	0	3	1403	0	6	1415	0	10
1356	1	3	1368	0	3	1380	0	3	1392	0	3	1404	0	3	...		...
1357	0	3	1369	0	5	1381	0	3	1393	0	7	1405	0	3	...		...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Jan. 17, 1862.

		£	s.	d.		£	s.	d.	p.ct
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	6	0	0	nett
Welsh Bars, in Wales	„	5	5	0	„	5	7	6	2
Staf. Bars, at the Works	„	6	10	0	„	7	5	0	2½
„ Hoops	„	7	10	0	„	8	0	0	„
„ Sheets, Singles	„	8	0	0	„	9	0	0	„
„ Nail Rods	„	6	15	0	„	6	10	0	„
„ Boiler Plates	„	8	0	0	„	8	10	0	„
Scotch Pig, M. Nos. Warrants, at Glasgow	„	2	7	6	„	2	8	4	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	3	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	2
Tough Cake and Tile	pr. ton	98	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	103	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9½	„	0	0	0	„
STEEL.									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	18	0	0	„	0	0	0	„
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	6	2	0	„	6	3	0	net
Straits	„	6	0	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I C.	„	1	1	6	„	1	4	0	„
LEAD:									
Pig, English	pr. ton	19	10	0	„	20	0	0	2½
„ Spanish	„	19	0	0	„	19	10	0	„
Common Sheet	„	21	10	0		22	0	0	„
Tea „ [Wimshurst's Patent] A special disct.	„	33	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	18	5	0	„	0	0	0	nett
For arrival	„	18	5	0	„	18	7	6	„
ZINC.									
English Sheet	„	24	0	0	„	0	0	0	
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 24, 1862.

THE HARTLEY CATASTROPHE.

ON Thursday, the 16th of this month, the large beam of the pumping engine of the Hartley Colliery Pit, suddenly broke in two pieces; one piece, weighing upwards of twenty tons, fell into the pit, and in its fall broke away the "brattice" work, and carried with it, bricks, stone, timber, and earth, in tremendous confusion, and so jammed up the pit to the depth of thirty fathoms. The accident occurred just when 215 men and boys, who had been working all night, were about to ascend, to make room for the descent of a similar number. In a moment 215 human beings were cut off from all communication from the surface, or in other words, *buried alive.* Every effort that burning sympathy could inspire, that science could suggest, and that strong arms and dauntless hearts could perform, was made to re-open the shaft, and render succour to the unfortunate. Hour after hour, day after day, and night after night, the holy work went on. Difficulty after difficulty had to be encountered and conquered. The men worked, and the women wept, hour after hour, day after day, and night after night, when hope itself grew fainter and fainter, until it merged into despair. Multitudes of men and women have at different times in the history of this country endured agonizing periods of suspense, but never did hearts beat with intenser anxiety than did those of the men who were buried in the Hartley Pit, and the women and children round its mouth, during the week from the 16th to the 22nd of this month. No pen or tongue will ever describe, first, the hope mingled with fear, and secondly, the agony, only fringed with hope, until blank despair took possession of every heart under and on the soil.

We must not, however, linger over the dead, but devote our attention to the living. The past cannot be recalled; it may, however, be used to improve the future. Philanthropy, science, and enterprise, must now be pressed into the service of humanity, to avoid, if possible, such awful accidents. The fate of the miner is at all times an unenviable one. He is subject to more than the ordinary inheritance of ills to which flesh is heir. The impure air which he is obliged to breath while gaining his daily bread, the liability of fire-damp explosions, the inundations which sometimes flood his mines, and other similar casualties, make his lot precarious and unfortunate. This being the case it is highly desirable, in fact necessary, that every precaution should be taken to protect his health and life. Had the beam which so suddenly snapped at Hartley been made of wrought iron, instead of cast iron, or had it been constructed of rivetted plates, as bridges are now made, the probability is that this accident, with its long list of unrecorded woes, would not have happened. Cast-iron beams are cheapest, we admit, but in a case like this, were the issues are of such importance, *security* should be considered before *cheapness.*

The Hartley Pit is one of the deepest of the kind in the kingdom. On account of its great depth, and the more than ordinary influx of water into it, which has been supposed to be infiltered from the sea itself, the mine for a long time past has scarcely paid. This is the reason, we suppose, why it has been so economically conducted. But it is not a sufficient reason why there should be only *one* shaft. The very least thing that the proprietors could have done would have been to have two shafts. Had this been done, all the men, or nearly all of them, would have been saved. "Even the "wild animals," says the *Daily News*, "that "burrow in holes provide themselves with a "double mode of exit, so that if an enemy enters "by one hole, they may escape by the other. "Reason, it seems, under the name of economy, "refused to our fellow-creatures what instinct "provides for the lower animals." The miners at Hartley had enemies enough to fear. Water, fire, and suffocation might at any instant break in upon them. Yet, however these foes might approach, there was but one way of escape left. If that should fail, it was always evident they must perish. It cannot be that it is needful for our national greatness to work our natural wealth at such peril; and if such mines as that of Hartley cannot be wrought if the expenditure of a second shaft must be undergone, it would be better if they were abandoned. Probably, there are not many mines in a similar condition in the country; but be they few or many, every one of them should in future be provided with more than one shaft. This is a matter in which, we think, the Legislature might, with propriety and justice, interpose.

Having indicated what in such cases should be done in other mines, let us say a word or two in behalf of the surviving relatives of those who have recently perished. The village of Hartley is now filled with helpless widows and orphans. Surely British philanthropy will pour some few drops of comfort into their deep cup of sorrow. They have just passed a week of indescribable anguish, and they have now to look forward to many weeks of a joyless existence. It is the distinguishing privilege of the wise to guide the ignorant, of the strong to protect the weak, and of the affluent to assist the poor. The pitiless storm of grief which has fallen on the inhabitants of this village may, to a large extent, be broken, and hearts now weighed down with woe may be lightened, if those who are able will lend a helping hand. We hope a national subscription will be made, and that men and women who sit by hearths made warm and bright by coals obtained through hardship and peril, will respond with cheerfulness to the benevolent appeal made to them. Should any who desire to contribute to this object wish to make the office of the MECHANICS' MAGAZINE the channel of their benevolence, we would gladly acknowledge in our columns the donations received, and transmit them to their proper destination.

NOTES ON REMARKABLE EXHIBITIONS.

IT has frequently been stated that the great Hyde Park Exhibition of 1851 was the first display of the kind which partook of an international character. Exhibitions of art and industrial products had taken place in France, England, and Germany before 1851; but they were essentially *national* in their features and purposes. If, however, we appeal to history, we shall find that the Exhibition of 1851, though unlike anything that preceded it, was not the first to embody cosmopolitan elements. Long before 1851, and even before the Christian era itself, something like exhibitions were witnessed in Greece. The Olympic Games were said to be established by Hercules, in honour of Jupiter, after a battle gained over Augius, 1222 before the birth of Christ. They were celebrated every five years, with some few interruptions, for several centuries. At those games many of the ablest and most renowned citizens of the various republics and kingdoms of Greece, and of the other countries which bordered the Mediterranean Sea, met together in order to test their physical strength and artistic skill. Wrestling, boxing, running, leaping, throwing the quoit, foot, horse, and chariot races were witnessed by assembled thousands. Not only the physically strongest sons of Greece met at Olympia to contend for the olive crown, but historians, musicians, orators, and poets submitted their productions to the criticisms of the multitude. Thither went Alcibiades, with his Arabian horses and his splendid chariots; and it was before the same tribunal that Heroditus read his historical works; that Lycias, the famous Athenean orator, rehearsed some of his best speeches, and that Dyonisius, the Syracusan king, got laughed at for his miserable verses. Umpires were chosen to judge of the quality of the feats performed, and enviable honours were bestowed on the most meritorious. The Greeks thought nothing comparable to the fame achieved at those games. Cicero says that the honours gained at such periodic contests was held in higher repute than even the consular dignity, in all its original splendour, by the ancient Romans.

As modern industrial and artistic exhibitions indicate the character of the age, so did the Olympic games represent, to a great extent, Greek civilization. The Greeks, though artistic and intellectual, were essentially martial, and physical courage and capabilities of endurance were the soldier's best qualities. Gunpowder, steam, and engineering skill, were not then used in war. Armies had to march hundreds, and sometimes thousands of miles, and if the men had not been tried and tempered by previous exercise and discipline, they would have perished on the way. Alexander would never have been enabled to march a mighty army into the heart of Asia, had not his soldiers been inured to fatigue by previous training. Neither could the "famous ten thousand" have accomplished the most extraordinary walking match in history, nor Xenophon have lived to record the history, but by such help.

We must, however, leave Greece, and take a leap over many centuries, and glance for a moment at an Italian exhibition. At the beginning of the fifteenth century, just when Raphael had sunk like a star in its meridian, an Italian artist, named Francisco Squarccone, conceived the idea of instituting an exhibition of paintings and sculpture at Padua. Being an enterprising and wealthy man, he visited several of the most famous Italian cities, and collected many art-treasures. He afterwards visited Athens and Constantinople, and returned laden with some of the best specimens of Greek and Asiatic art. Those that he could not purchase, he copied with his own hand. He then opened his exhibition, or museum, in connection with a school of painting. This school was at one time attended by upwards of 130 students, among whom were Belini. This may be considered the *first* modern historical exhibition of the fine arts.

From Italy we must transport our imagination to France. The great revolution was stirring the minds of the French people, and ideas and schemes unthought of before, assumed a shape and purpose. In 1796 the working classes of Paris being sorely depressed, the Marquis D'Avéze, commissioner of manufactures, suggested that an industrial exhibition should be held at St. Cloud. A few years since, a pamphlet, detailing the history of this exhibition, was written by the Marquis himself, from which we will translate a passage. On one occasion, after visiting some of the abodes of the poor, he says, "Scarcely can I "depict the effect produced in my mind by "such a scene; but all of a sudden a luminous "thought presented itself to my imagination. "I pictured to myself, in the most glowing "colours, an exhibition of all the objects of in- "dustry from the national manufactures. I "addressed myself to the Minister of the "Interior, who clothed me with authority to "carry my plan into effect." The object of the Marquis was to stimulate industry and lighten the burdens of the poor. The first agonizing struggles of the revolution paralyzed for a time his good intentions. The nobility had to leave Paris. On the return of the Marquis, he recommenced his labours with untiring devotion; and he had the satisfaction of witnessing the *first* European industrial and artistic exhibition of note. The exhibition, however, did not take place at St. Cloud, as originally designed, but at the Maison D'Orsay, Rue d'Varrennes. It consisted of painting, statuary, and manufactures. The finest Gobelins tapestry adorned its walls, the richest carpets of Savounerie covered its floors, and the most exquisite Sévres china enriched its saloons. Though it was exclusive in its character, it answered the purpose of its designer.

When Napoleon Bonaparte returned from his successful campaign in Italy, he brought with him many spoils of victory. Ever ready to press the most auspicious circumstances into his service, the great general determined, that as war had secured a triumph, peace should have an ovation. The army celebrated its successes by a collection of war trophies, in the Champ do Mars. The trophies vanished as if by magic, and six weeks after there rose on the same spot "the Temple of Industry." This temple stood in the midst of sixty porticoes, which were filled with the most useful and beautiful productions of the different departments of France. Umpires were appointed to examine and decide on the best articles, and to distribute prizes to the most deserving. This may be called the first *official* French exhibition. It was intended to have followed it with an annual exhibition of a similar kind. That, however, was too great a task, and it was subsequently determined to have a triennial French exhibition. The second took place in the Louvre, and like the first, it celebrated the anniversary of the Republic. During the three years, the scheme had deepened and extended itself. Not only Paris, Lyons, and other French towns, contributed to this second official exhibition, but also Milan, Leige, Brussels, and Axe-la-Chappelle. This exhibition was, therefore, not merely *French*, but Italy, Belgium, and Germany, contributed to it, and thereby gave it something of an European character.

The next exhibitions which attract attention are of English origin. Though England did not originate exhibitions, she has probably done more than any other nation to develope and utilize them. The Society of Arts first began the work in this country; and for many years previous to the Hyde Park gathering, that Society was the means of holding triennial exhibitions, at which objects of British art and manufacture were shown. There was, however, nothing remarkable about these periodic collections, and they were but poor imitations of their Parisian prototypes. They were scarcely equal in quality or quantity to others held at Munich, Berlin, and other European capitals, and were even inferior to some exhibitions held in Manchester.

In 1837, the directors of the Manchester Mechanics' Institution determined on having an exhibition on a large scale, and they succeeded in bringing together, in one building, the most extensive collection of British products ever before exhibited. Other Manchester exhibitions followed, one of which was attended by 150,000 visitors, and realised a revenue of several thousand pounds. The Institution was by these means rescued from difficulty, and raised to prosperity and power. Then followed the Anti-Corn Law League Bazaar, in Covent Garden Theatre, in 1845, and which was only excelled in magnificence by the Universal Exhibition of 1851.

The Great Exhibition was a landmark of history, and will ever be regarded as the most wonderful monument of British industry and enterprise up to the time at which it was held. It was as universal and cosmopolitan as it was possible to make it at the time. There was a concurrence of circumstances which contributed to its success. Europe had for many years enjoyed the luxury of peace, during which time it had made immense industrial progress. The mechanical arts had effected a revolution in the social condition of the people. England had just entered on a free trade career, after the most remarkable moral agitation in its annals. These, and other things, combined to prepare the way for the Hyde Park Palace and its treasures from all lands. The rapidity with which that palace started into existence, the spontaneous manner in which foreign governments responded to our call, the May-day opening, the general rejoicing at the marriage of Science and Industry, the presence of Royalty and Religion at the opening of the great festival of Labour, the zeal of competitors, the presence of hundreds of thousands of all nations, talking almost all languages, the direction of a good prince who has since passed away, the punctual closing, the iron pillars and glass walls vanishing more rapidly than they rose, the green grass once more growing where modern civilisation had put forth its greatest and best effort; these things read more like the kaleidoscopic chapters of an oriental romance than a solid English reality.

About four years since, an exhibition was held in Willis's Rooms, in London, and though comparatively insignificant in appearance, it was invested with a moral influence of no ordinary kind. The movement to reform our juvenile criminals and vagrants had resulted in the establishment of reformatories and industrial schools in many parts of England. In several of those establishments, the boys had made considerable moral progress, and exhibited considerable mechanical skill. It was, therefore, determined to make a collection of the most useful and ornamental articles made by the boys; and a most interesting exhibition, under the auspices of the Reformatory and Refuge Union, was the result. There were boots, shoes, several kinds of wearing apparel, books, bedsteads, lace, elaborately executed specimens of cabinet work, and a hundred other different kind of articles. In several parts of the room the boys were at work, plying their respective trades, thus giving the best practical proof of the value of the reformatory movement. This exhibition was little talked of; it was, however, visited by the late Prince Albert, who was ever ready to smile on every effort which aimed at the improvement of the people. He carefully examined the workmanship, talked with the boys, who but a short time before had the prison stain upon them, and purchased several articles to take with him to Buckingham Palace.

During the time the French Exhibition of 1855 was open, a Philanthropic Congress held its sittings in Paris. At this congress a resolution was passed, recommending the formation, in various counties, of collections of articles of domestic and sanitary economy used by the working classes. The committee that conducted the Philanthropic Congress in Brussels on the following year, acted on the advice given at Paris. They invited from many of the principal manufacturers of Europe specimens of domestic articles used by the working classes, in order to form an exhibition, to be held at the Conservatories of the Royal Botanic Gardens, Brussels. When the time came, this economic exhibition was opened. It consisted of plans, models, materials, and various processes connected with building; domestic appliances; clothing of all kinds; food, and the various processes involved in its preparation; tools and instruments; diagrams and maps, for physical, moral, and intellectual education and recreation. There were model cottages, and model gardens, in miniature, showing how space might be economized, how ventilation might be most easily effected, how fuel might be consumed to produce the maximum results, and how domestic comfort might be realized by the smallest expenditure of means.

A similar exhibition to the one held in Brussels was opened under the auspices of the Society of Arts for some time. We believe the articles of which this exhibition consisted were chiefly produced or collected by Mr. Thomas Twining, junior, and that they now form a valuable collection adjoining his residence at Twickenham.

A word on the exhibition of art-treasures at Manchester will conclude our article on remarkable exhibitions. The Manchester gathering differed essentially from all its predecessors. It enabled the art-student, and all others interested, to trace the development and vicissitudes of art, from the Middle Ages to its meridian glory in the Fifteenth and Sixteenth centuries; and to see how the various schools of art had influenced and modified each other. It was remarkable that Manchester—the city of workshops, warehouses, steam, smoke, and spindles, where it was supposed the pursuit of gain over-rode and absorbed every other passion and interest, and where "cotton politics" were supposed to reign supreme, to the evident discomfort of certain institutions grey with the dust of ages;—it is remarkable that such a city should evince such an enterprising spirit and such a strong love of art. The marriage of Vulcan with Venus only typified the union of Manchester with the Beautiful. The exhibition was pre-eminently successful, and reflected honour on the city in which it was held.

ON FUEL.

ARTICLE 1.—INTRODUCTORY.

IN the series of papers of which this article constitutes the first, we propose to enter on the consideration of the important subject of fuel, chiefly in relation to its practical aspects.

Until the publication of Dr. Percy's valuable treatise on "Metallurgy," which we have so recently noticed, there was hardly a single accessible work in which the subject was treated with the attention that its importance demands.

In the last edition of "Ure's Dictionary," for example, the article on "Fuel" is barely eight pages in length, three of which are devoted to a tabular account of the trials of coal at Woolwich; we looked in vain for any notice of the researches of Favre and Silberman, or of our countryman Andrews, on the calorific powers of fuel, although these researches have been ten years before the scientific world; and we are compelled to put up with the often-quoted experiments of Runford, Lavoisier, and others, that were new some time in the last century.

It is not that there has been any deficiency of investigation into the nature and heat-giving powers of fuel, but the papers detailing them have been scattered through so large a number of scientific and technical journals, particularly those of the continent, that they seem to have escaped the notice of the compilers of practical treatises. To Dr. Percy, therefore, great credit is due for his industry in investigating so large a mass of material, as he has had at his disposal, and for the practical manner in which the more useful details are made available to the English reader.

In the following articles, we shall follow the arrangement this author has laid down, and shall not unfrequently have occasion to avail ourselves of his valuable labours.

By the term fuel is generally understood those bodies which can be made available as sources of heat, which they give out during their oxidation. The term does not admit of any very strict definition—a heap of stable manure would hardly be regarded as burning fuel, though, in reality, a slow oxidation, attended with the formation of carbonic acid, and the evolution of heat, is constantly going on. Nor is the fat pemmican eaten by a Canadian voyageur usually so regarded, nevertheless, it is taken into the body that it may undergo a slow oxidation in the system, and maintain the heat necessary to the body during the intense rigours of a northern winter.

The substances employed for fuel are usually derived from the vegetable kingdom, and consist essentially of the two elements, carbon and hydrogen. Animal matters are occasionally employed. In some countries, for example, there is so great a dearth of vegetable fuel that the bones of animals are employed in consequence of the fat they contain. And the metal lead (as obtained in a finely divided metallic state from heating its tartrate in a close vessel), takes fire when poured out into the open air, uniting with oxygen, and furnishing an example of a metallic fuel.

All fuel used for practical purposes may be regarded as vegetable matter, either recent as wood or charcoal, or more or less fossilized in the form of peat, coal, &c. The practically useful constituents of vegetable fuel are two—carbon and hydrogen, although, in a greater number of instances, oxygen is present in varying proportion. The products of the combustion of the two elements, carbon and hydrogen, carbonic acid and water respectively, and, provided the combustion is perfect and complete, the amount of heat given out by any portion of fuel is fixed and definite, whatever may be the circumstances under which it is burned, and whether the combustion be effected with rapidity or slowness.

Whilst, however, the quantity of heat remains the same under whatever condition it may be burnt, provided perfect (and not incomplete) combustion be ensured, the intensity of the heat is subject to great variation. By rapid combustion a very intense heat, lasting for a short space of time, may be secured, or by a slower combustion the intensity may be much lessened, although the amount of heat actually given out remains the same in both cases.

Combustion varies very greatly with the mechanical condition of the substance burned. A fixed solid, such as any of the varieties of nearly pure carbon: as anthracite, coke, or charcoal, burn slowly without flame, and the product of the combustion is carbonic acid. If, on the contrary, the combustible body yields an inflammable gas when heated, flame is the result. Flame, under all circumstances, is gaseous matter in a state of combustion. As the gases given out by a heated inflammable body always consist of compounds of carbon and hydrogen, the products of the combustion of a flame are carbonic acid and water.

One of the most important subjects connected with the employment of fuel is its calorific or heat-giving power. The actual amount of heat given out by any burning body cannot be stated, in fact we have no means of estimating it, but the relative amount given out by equal weights of different fuels can be ascertained with great nicety, and the enquiry is one of extreme value in the arts and sciences, also in a scientific point of view. The mode usually adopted is, to take one part, by weight, of the substance to be examined, and to discover, by direct effect, the number of parts of water that can be raised in temperature one degree by its perfect combustion. Let us take an example. One part of charcoal burning in the air unites with two and two-thirds of oxygen, and forms carbonic acid. During this combustion a sufficient amount of heat is produced to raise the temperature of 8,000 parts of water by one degree of the Centigrade thermometer. On the other hand, one part, by weight, of hydrogen gas, unites, when burning, with eight parts, by weight, of oxygen, and forms water by the combustion. During the union a sufficient amount of heat is evolved to raise the temperature of 34,000 parts of water one degree of Centigrade. The calorific, or heat-giving powers of carbon and hydrogen, are, therefore, in the proportion of 8,000 to 34,000, or in other terms, hydrogen, in burning, gives out rather more than four times the heat given out by an equal weight of carbon.

In all comparative investigations it is of importance that there should be a standard of comparison by which all results should be measured. The French experimenters have adopted, as the *unit of heat*, the amount of heat which is required to raise the temperature of one gramme (15·432 English grains) of water one degree Centigrade.

We have already stated that the calorific or heat-giving power of charcoal when undergoing perfect combustion is 8,000, inasmuch as it raises the temperature of 8,000 times its weight of water one degree C. But charcoal is capable of undergoing a less perfect combustion, when it unites with only one and one-third its weight of oxygen, and passes into the condition of carbonic oxide. This imperfect combustion takes place whenever there is a limited supply of air. The recognition of this fact is of the utmost importance in a practical point of view, for when thus imperfectly burnt, the calorific power of carbon is only 2,470 instead of 8,000. Hence the close stoves, which are usually known under the title of slow combustion stoves, are not as economical as manufacturers would have us believe.

Their advantages and disadvantages have been so fairly stated in a recent number of our contemporary, the *Ironmonger*, that we extract the passage:—

"By a slow-combustion stove is meant such a contrivance for burning fuel as enables the entrance of the air to be regulated to any required extent. Whilst there is abundance of fuel in the fire-box, the burning can be made to go on at a very reduced rate. There is then a reduction in temperature, corresponding with the reduction in the supply of air, until at last the heat may fall so low that the combustion is no longer kept up, and the fire is extinguished.

"But, it must be confessed. that this, though a true statement of the case, is not the whole truth; and that it involves such a suppresson of part of the evidence as renders the advocates of slow-combustion stoves open to a charge, not, perhaps, of *suggestio falsi*, bu of *suppressio veri*, in their statements on this subject.

"When fuel is burnt in a confined portion of air, combustion is tolerably perfect in the immediate neighbourhood of the air-hole; the carbon of the coke is consumed, and carbonic acid is formed by its union with the atmospheric oxygen. But as this carbonic acid passes over the heated, unburnt carbon, it takes up an additional quantity of carbon, precisely equal in amount to that which had been previously consumed. This reduces the carbonic acid to the condition of carbonic oxide, which, being a gas, escapes by the smoke-flue or chimney. This, however, it it will not do, if a sudden draught or current carries into the stove an additional quantity of air. In such a case, a slight explosion may happen, such as is familiar to all who have used Arnott's stoves.

"It is obvious that the additional quantity of carbon which goes to the formation of the carbonic oxide is not burnt; and, consequently, its escape is a loss of so much fuel, attended with no corresponding increase of heat. These are not mere theoretical statements; but were proved experimentally by Sir Humphrey Davy, and since by Dr. Ure. The latter experimenter says:—'I set upon the top of a cylindrical stove a hemispherical copper pan containing six pounds of water, and burn briskly under it three pounds and a-half of coke in an hour, at the end of which time four pounds and a-half of water were boiled off. On burning the same weight of coke slowly in the same furnace, surmounted by the same pan, in the course of twelve hours little more than one-half the quantity of water was exhaled.'

"We do not feel sure that this experiment is a very fair test; as, unless the water was raised to the boiling point in the latter experiment, the cases were hardly parallel. But we adduce it to prove, not the exact amount of loss of heating power, but the truth of the principle laid down.

"Again, if the combustion be kept very low so that the temperature in the upright shaft is inconsiderable, the greater specific gravity of the carbonic acid and carbonic oxide over that of the air, is not overcome by the increased temperature. Consequently, they flow out of the air-hole instead of passing up the chimney; and thus deteriorate very greatly the surrounding atmosphere."

The singular fact that when carbon burns, and produces carbonic oxide it only evolves *less* than one-half the amount of heat produced by its perfect combustion, proves the erroneous character of the theory, which was formerly received, that the amount of heat evolved during combustion, was proportionate to the amount of oxygen consumed. In the imperfect and complete combustion of carbon, the relative amounts of oxygen is as one to two respectively, whereas the amount of heat evolved is as 2,470 and 8,000, consequently the consumption of a double amount of oxygen in the latter case is attended with the evolution of three times the amount of heat.

The calorific power of pure hydrogen is very high, being greater than that of any other body, compared with that of carbon, it is, as before stated, as 3,400 to 8,000.

The gas obtained by the destructive distillation of coal varies so greatly in composition that it is impossible to state its calorific power with any degree of certainty. Its chief constituents are the light and heavy carburets of hydrogen; of these, the light, as containing a greater per-centage of hydrogen, has the higher calorific power, taking a rough average, the heat-giving power of ordinary coal gas may be estimated with a sufficient degree of accuracy for all practical purposes at 12,000, or, in other words, it produces in burning half as much heat again as carbon.

With regard to the other substances used occasionally for fuel, they have not a very high practical interest, and, with the exception of alcohol, we are not aware of any experiments that have been made respecting them.

The calorific power of pure anhydrous alcohol is about 7,000, ordinary commercial spirit would be much lower, as, in addition to the mere diluting effect of the water there would be a great loss of heat in effecting the evaporation of that impurity. Sulphur has a low calorific power, barely more than 2,000, so that it could never become a valuable fuel, however abundant it might be.

Phosphorus is rather under 6,000, and the most inflammable of our ordinary metals, namely zinc, only 1,300.

With regard to wood spirit, we should estimate it in the absence of any direct experiment, as about the same as alcohol, and the various paraffine oils are so varied in composition, that it is almost impossible even to appproximate to their calorific value.

In our next we propose to enter into the consideration of wood and turf.

Literature.

A Manual of Metallurgy. By GEORGE HOGARTH MAKINS, one of the Assayers to the Bank of England, &c., &c. London: F. S. Ellis, King-street, Covent-garden. 1862.

THE deficiency of works on metallurgy in the English language, to which we lately alluded, appears likely to be speedily supplied. In addition to the recently-published treatise of Dr. Percy and its promised continuation, we have before us another work on the same subject, written for a different class of readers.

Dr. Percy's is an exhaustive work, peculiarly addressed to the smelter, the scientific chemist, and the students in the different schools of mines.

Mr. Makins' is a much smaller treatise, based upon the lectures on metallurgy delivered by him before the students at the Dental Hospital, and, therefore, as may be readily imagined, more particularly addressed to the technical and practical details of the subject. The precious metals those which are most important to the mechanical dentist especially receive a large share of attention.

Mr. Makins' work commences with a chapter descriptive of the general properties of the metals, their malleability, ductility, opacity, &c., &c. In describing the transparency of gold in very thin layers, he gives an illustration which may be new to many of our readers:—"This transparency," he says, "may be elegantly demonstrated, by taking some twenty grains of fine gold, and fusing it in a convenient shallow vessel; this is to be removed from the furnace in a completely fluid state, when, if watched, it will be observed that just upon cooling a crust of solid metal will first suddenly form, through which the light of the internal red-hot mass appears of a beautiful brilliant green colour."

The author then passes rapidly in review the properties of the compounds of the metals both with the non-metallic elements and with each other. The characters of the compounds produced, such as the different groups of salts and the alloys, are also described.

The different varieties of heating apparatus, and the properties of the various fuels, are then noticed.

The consideration of the different metals, the history, the description, occurrence, and reduction of the ores, the properties and compounds of the metals themselves, next follow. This part of the work is more especially practical; and, in addition to the original facts which the author has brought forward, he has most carefully collected and condensed the subjects treated of by previous writers, and has really rendered, as he claims to have done, good service to those whose avocations leave them but little time for very extended reading on the subject of metallurgy.

In order to give our readers a correct idea of the character of the work, we will make a few extracts from the later chapters. It is usually stated that the property of welding is confined to the two metals, iron and platinum. Mr. Makins, however, states that "pulverulent gold, or any of the forms of the precipitated gold, are capable of being welded together, even when cold, by simple pressure. But this pressure requires to be exercised moderately at first, and then gradually increased, in order to get solidity, otherwise a solid skin will be formed over the interior metal, which remains somewhat disintegrated. The author is in the habit of welding considerable quantities of gold, precipitated by oxalic acid, but this is done in compact solid masses by heating them to dull redness in a platinum crucible and hammering, the cakes of metal so made have all the texture of fused gold."

From the chapter on tin we take the following valuable practical remarks:—

"The alloys of tin with lead constitute pewter, and also an important class called 'solders;' and, in regard to these, it may be remarked that mixtures of tin and lead are not only more fusible than the mean of their constituents, but they are also harder and considerably tougher. In forming them the lead should be fused first, and then the tin put in; thus oxidation of the latter is diminished as much as possible; and this object may be also furthered by covering the contents of the melting-pot with charcoal or anthracite powder. When the amount of tin rises a little above one-third of the mixture, and up to two parts of tin to one of lead, the alloy will throw out well-defined circular spots upon its upper surface when cast in a sheet. This depends upon partial separation of the components of the alloy when in these proportions; but as it becomes yet richer, the spotting gradually disappears, and is as much absent at last as in an alloy containing below the amount of tin above-mentioned. Indeed, this appearance affords the plumber the indication of the quality of solder he is making.

"The addition of bismuth to alloys of tin and lead is found to lower their melting point in so extraordinary a degree as to have given the name 'fusible metal' to this triple alloy. Some of these mixtures melt at points below 212, or the heat of boiling water; and the proportions which will give the most fusible compound are two parts of bismuth to one of lead and one of tin; and it will be seen, upon considering the equivalents of the metals, that these quantities will be just about two equivalents of tin to one of lead and one of bismuth. This alloy is largely employed for taking casts, and its value for this purpose is much increased by the fact of its expanding on cooling; and hence giving extremely sharp and well-defined models.

"An alloy of these constituents is employed as a soft solder for pewter. The proportions for this are 1 part of bismuth to 2 of tin and 1 of lead.

"Tin alloyed with antimony constitutes Britannia metal, the best varieties of which are composed of tin, with just sufficient antimony to give hardness. For this purpose the proportions of antimony may range from 8 to 12 per cent. Some kinds contain also bismuth, zinc, and copper, but these are inferior to the first formula.

"An inferior kind is made under the name of 'Queen's metal.' In this 75 parts of tin are alloyed with 8·5 parts of antimony, 8 of bismuth, and 8·5 of lead; but the use of the latter metal is always avoided in good Britannia metal.

"The ordinary kinds of type metal are formed of lead, with antimony added in such quantity as to harden it, and enable it to sustain the wear of th press. Twenty parts of antimony to 80 of lead form a good alloy, as such metal fuses readily, and gives sharp casts; but it has been found that if a small amount of the lead is substituted by tin, the type is yet sharper, and resists wear much better. For this 5 per cent. of tin is found sufficient. Thus an excellent metal is formed of lead 75, tin 5, and antimony 20 parts.

"Tin may be combined with copper in any proportion, and forms with it alloys known as gun, bell, and speculum metals, or bronze; the relative proportions of the constituents determining the character and uses of the alloy. Bell metal is formed in the proportion of 78 parts of copper to 22 of tin; to these 2 per cent. of antimony is occasionally added. In gun metal for ordnance purposes only 10 per cent. of tin is mixed with 90 of copper; but this proportion is often exceeded in metal for engineering uses. Speculum metal is an exceedingly hard alloy, capable of receiving a very brilliant surface by polishing; whence it is employed for the reflectors of telescopes. It is somewhat brittle. For the best result the copper and tin should be in the proportion of 2 to 1, and a little arsenic improves its quality. Thus a good formula is—6 parts of copper, 3 of tin, and 1 of arsenic.

"Genuine bronze is a compound of copper and tin only, but much of this alloy contains zinc also, as the new coin of this country, for example (page 408). Where metal is intended for the die-press a good proportion will be 93 of copper to 7 of tin. This forms an alloy much harder than copper, and also more fusible. It will resist oxidation better, but its hardness renders annealing necessary when it is used for coinage purposes. With respect to the method of annealing, Mr. Brande, Her Majesty's chief coiner, states, that tempering, or heating and slowly cooling, produces an effect directly opposite to that taking place in steel, and that it renders bronze quite hard and brittle. Therefore, it is heated to redness, and quenched in water. After which it is found to be quite soft and workable under the press or in the lathe. Bronze is very liable to have air-holes formed in casting; and its constituents have much tendency to separate upon fusion."

Zinc and tin will alloy readily, and when combined in equal proportions, they form a white hard alloy, which may be worked as readily as brass.

The chapter on aluminium is rather scant in its practical details; but we feel, in justice to the author, compelled to notice it, as our respected contemporary, the *Athenæum* in reviewing Mr. Makins' work, makes some extraordinary mis-statements respecting aluminium and its uses, that may by its readers be mistaken for those of Mr. Makins'. The most serious of these is the suggestion of its use as a material for safety-lamps in coal mines, because its specific heat is so high that it may be long exposed to heat before it becomes red-hot, and that when the lamp is filled with flame by the eruption of fire-damp, *perhaps*, it would never melt in the mine.

The suggestion to employ a metal that melts below a red-heat as the material for a safety-lamp is one of most startling that we have met with for some time. It is quite evident that Mr. Makins' treatise, by some mistake, got into the hands of a literary, and not a scientific, contributor, to our usually correct contemporary.

ERRATUM.—For Iceland read Ireland on the first column, page 29, of last number.

TELEGRAPHIC INTELLIGENCE.

An important change will take place in the tariff for messages by telegraphs between the various stations in great Britain on and after February the first. After that date, the charge for any distance under fifty miles, will be one shilling; under one hundred miles, eighteen-pence; under two hundred miles, two shillings; three hundred miles, three shillings, and four hundred miles, four shillings. The effect of this will be to lower the price by 25 per cent. between London and all the principal places in Lancashire and Yorkshire, and between those places again and the principal Scottish cities. The tariff between London and Scotland will continue as before. This state of things has been brought about by the competition of the United Kingdom Company, who have now opened a portion of their lines at shilling rates, and profess their intention of making that rate universal. irrespective of distance, so soon as the means are afforded them of opening further extensions.

The necessity for rapid communication with America, has for some time past developed a very considerable telegraphic business between London and other places in England. and the regular packets calling inwards and outwards at Queenstown Ireland; and there are now two new submarine companies before the public seeking to improve the communication to the latter place. These are stated to have their existence from the general dissatisfaction of the London public, at the manner in which the telegraphic service, from and for the American packets, has recently been conducted. One of these new companies is under the auspices of Messrs. Silver and Company, and of the directors of the United Kingdom Company, who propose (if successful in raising their capital of £100,000) to lay down a cable composed of copper insulated with India-rubber in place of Gutta-percha. and in addition to this novel experiment, it is intended to apply Mr. Siemens' principle, which is as yet untried, to the external protection of the cable. This plan consists of a metal band or tape applied spirally to the exterior instead of iron wires as heretofore. This will be a difficult cable to pay out or manage in water.

The other project is in connection with the Electric and International Telegraph Company, but is nevertheless, in itself, a separate company. The capital (which is to be £30,000) is all provided, and the cable of the best known description under the existing and tried plan of gutta-percha insulation, and heavy external iron armour. protected from oxydation, is actually contracted for to be laid before May next, between St. David's Head and Wexford.

The Electric and International Company have secured satisfactory and substantial terms to this subsidiary company, and have undertaken to connect their lines to it at St. David's Head, and to extend them on the other side to Queenstown.

It is further the intention of the Electric Company, to extend their system to all the principal towns in Ireland during the ensuing spring.

The cable of the Electric Telegraph Company between England and Holland is about to have massive shore ends applied to it for protection in the anchorage ground near shore. These will be of unprecedented strength and solidity, founded upon past experience. Their weight will exceed 16 tons to the mile, owing to the size of the external iron armour.

Statements have appeared in the daily papers, to the effect that Glass, Elliot and Co., have tendered to the Government, to lay and maintain during twelve months, a cable between England and Halifax, Nova Scotia, for the sum of 700,000*l*. This is altogether incorrect.

A tender has been received by Government from that firm, to lay a line between *Ireland* and *Newfoundland* (the route along which the Atlantic Telegraph Company achieved their great but temporary triumph); but this tender was without any guarantee, and nothing is likely to come of it. The original Atlantic Company, however, we are informed, are collecting their forces energetically, and are likely to be before the public shortly, with substantial propositions for raising new capital.

The expedition for attempting the partial restoration of communication with India by the Red Sea telegraph lines, sailed on the first of this month. Mr. Latimer Clark, Mr. I. C. Laws, and a staff of electricians and workmen, left for Alexandria by the overland route, on the 4th It is much desired, if practicable. to complete the land line between Alexandria and Suez, and thence to the Island of Jubal, in the Gulf of Suez—360 miles from Alexandria, in distance, and 40 hours in time. This will, in connection with the line to Malta, be an important step; even if Mr. Clark and his collaborateurs are no further successful—as we sincerely hope they may be—in getting the line to work between Kurrachee and Aden also. The existing agencies at Aden, Bombay, Galle, Madras, Calcutta, Penang, Singapore, Hong Kong, Shanghai, King George's Sound, Melbourne, Sydney, Mauritius, and Reunion, will enable the messages of the public to be sent to and from those places to England, at a charge not exceeding £3 per message.

The Malta and Alexandria cable is working admirably, and already, in its comparatively isolated and undeveloped state, the receipts are over £600 per week.

The deep sea line, laid by Glass and Co., between Toulon and Algiers, is also in admirable working order, as are also the cables between the Balearic Isles and Spain, laid by W. T. Henley. Both these lines have now been working admirably for a considerable period. and in each case the depth of water in many parts exceeds 1,800 fathoms.

NOTES ON THE INTERNATIONAL EXHIBITION.

The following arrangements for admission have been made by Her Majesty's Commissioners. Season tickets will be issued at three guineas each, and the holders will have the exclusive privilege of being present at the opening ceremony, on the first of May.

Arrangements have also been made with Her Majesty's Commissioners for the International Exhibition of 1862, for the issue of joint tickets (price five guineas), conferring a personal free admission both to the Exhibition and the Royal Horticultural Garden. This ticket is to be obtained from the Commissioners, who will account to the Society for a share of the proceeds.

The *Journal of Commerce*, speaking of American contributions to the Exhibition of 1862, says:—

"The settlement of the Mason-Slidell affair has removed the apathy and distrust which had begun to be felt in this country with regard to the Great Exhibition, and the offerings are now coming in as freely as before. In order that our inventors and producers may have no real cause of complaint about want of time, the departure of the Government vessel will be postponed to about the last of this month, or nearly two weeks later than the date originally fixed for her sailing. It is probable that many contributions which have been held back under the apprehension of war will now be sent in from the loyal States, and that every available cubic inch of space on the ship will be occupied. Among the interesting contributions lately made, and accepted by the Commissioners, are a 'tractomotive,' or steam-engine for travelling on common roads, and drawing ploughs or harrows; and Dr. Feuchtwanger's complete collection of American minerals."

We understand that it is in contemplation by the Commissioners of the Exhibition to put out the striking of prize medals to contract. This seems to us to be a regrettable fact. The contract system is excellent in some matters, but would be quite misplaced in the production of such works of art as the prize medals would be. We know that Machie and J. Wyon have done their utmost in the production of the die for the medals; it is elaborate, chaste, and beautiful. Is it well then to entrust its use to the hands of contractors, who would study more the amount of profit to be gained from the execution of the work, than the delicate finish which ought to be given to the medals?

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

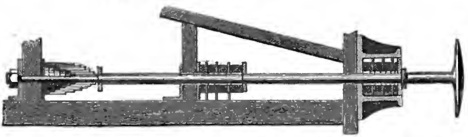
The seventh annual meeting of this association was held in the Town Hall, Manchester, on Tuesday last, Mr. W. Fairbairn, LL.D., F.R.S., the president, in the chair.

The report, of which the following is an abstract, was taken as read:—The number of members, as well as the number of boilers under inspection, have increased during the past year; and at the close of 1861 the association numbered 430 members, and had under inspection, at 535 factories and other works, 1,454 boilers and 1,030 engines, representing approximately a total of 127,065 indicated horses' power. The ordinary subscriptions, with the special service fees, amounted in the gross to £1,266 6s. No explosion had occurred to any boiler under the inspection of this association during the past year, while no less than 20 explosions were known to have happened in various parts of the kingdom, from which 27 persons had been killed, 47 wounded, and considerable damage done to property. 5,612 boiler inspections had been made, 52 boilers being found in a dangerous state: while, with regard to 266 others, it was necessary in 145 that the furnaces should be strengthened by hooping; in 52 that the shells should be strengthened by additional stays; and in 29 that the load on the safety valves should be reduced. The association had been in the habit, on the occurrence of any explosion within a reasonable distance of Manchester, of having a special examination and report made upon the boiler in question, so that the members should have the advantage of the information; and after alluding to the whole of the cases which have been examined in the course of the year, it was stated that it had been found that due care and periodical inspection, with the application where necessary of the hydraulic test, would have prevented every one of these explosions, and thus the word accident could not correctly be applied to any one of them. The report then went on to the consideration of engines and "Economy in the raising and use of steam," and pointed out the desirability of adopting a more satisfactory system than that now in use, which it is hoped the association will be the means of introducing ere long, stating that it would be extremely valuable if a complete table could be obtained of the actual net amount of fuel consumed, per indicated horse-power, by each engine under the inspection of this association. Such a table would form a true record of comparative economy, which would not only be useful to steam users, but also to manufacturing engineers, while it would establish a wholesome competition between all parties for the attainment of the highest degree of economic efficiency. The report recommended the application of steam casings or jackets to cylinders, and the adoption of superheated steam, stating the commercial advantages derived from these arrangements in other parts of the country, and concluded by stating that it was the desire of the association constantly to diffuse among the entire body of members reliable information on all points relating either to the safety of boilers or the economic use of steam; carefully avoiding the recommendation of anything untried or experimental. In this way it was thought that the association would continue to be a source of wealth to its members, as well as to the surrounding district, and the earnest desire was expressed that no year should pass without a decided mark of engineering progress being clearly stamped upon it by the association.

The report having been adopted, the Committee thanked, and the president re-elected,

Mr. Bazley, M.P., moved, and Mr. M'Connel seconded, the following resolution:—"That the meeting considers the system of voluntary periodical inspection to be worthy of the confidence of all steam users, and that this view is borne out by the fact that no explosion has occurred to any boiler under the inspection of this association during the past year, while no less than twenty explosions are known to have happened in various parts of the kingdom. Also this meeting wishes prominently to call attention to the fact that, in every case where exploded boilers have been examined and reported on directly to this association, it has been found that the explosion resulted from the simplest causes, and might have been prevented by the exercise of due care. This meeting, therefore, considers that the labours of this association

A. ALLAN'S IMPROVED BUFFER.



have established the following principle, namely, that the causes of explosion have been shrouded in unnecessary uncertainty and mystery, and takes this opportunity of expressing its conviction that explosions are considered far too frequently to be accidental, and that by due attention to correct principles in the construction of boilers in the first place, added to care in their working in the second, the recurrence of explosions would be prevented."

Mr. H. W. Harman moved, and Mr. William Booth seconded the next resolution:—That this meeting calls attention to the fact that the association by no means confines its attention to the safety of boilers, but includes all questions relative both to their efficient working and to the economic use of steam generally, and this meeting considers that the association, by the assistance it renders to engineering progress, is commecially valuable, not only to its own body of members, but also to the district at large.

A. ALLAN'S IMPROVED BUFFER

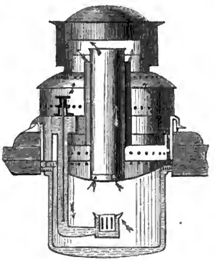
(From the *Transactions* of the Institution of Engineers of Scotland, 1861.)

The improvements in buffers for railway carriages have for object the obtaining of increased action or power in a given space, and the springs to be used may be of any of the well-known varieties of conic-vointe springs, of various sections of steel, and with springs of rubber or caoutchouc; or a combination of any of the above-named varieties may be employed, the strength, size, and stroke being modified as circumstances require.

The annexed engraving is a sectional view, showing the improvement as applied to the long-rod buffer. With this class of buffer any convenient number of springs may be applied, according to the resistance required. The figure shows three used in combination; and for the purpose of giving the springs independent action, each is furnished with a separate fixed abutment plate, on or against which the springs are placed. The central rod is then fitted with collars and washers, so that the force required to press the buffer-rod home will be equal to the united power of all the springs used in this manner. In this arrangement two of the springs used are of rubber, the other of steel; but the whole may be of either material, according to preference.

A. ALLAN'S IMPROVED LAMP FOR RAILWAY CARRIAGES.

In the roof lamps generally used for railway carriages the supply of oil is held in suspension above the burner, on the principle of the bird-fountain, the oil reservoir being perfectly air-tight, whilst the atmospheric pressure acts on the surface of the oil in the burner dish. The supply to the burner is consequently irregular and fluctuating, as the burner dish must be exhausted to a small distance below the orifice communicating between it and the reservoir, so as to allow of the passage of air-bubbles into the latter, before the supply can be renewed for feeding the wick. By this means the liquid level in the burner dish is constantly varied, causing an unequally charged wick, variable light, and, by frequently over-flowing into the lamp glass below, a waste of the necessary supply of oil required for long journeys. This last is also a great objection, as, besides its unsightly appearance, it serves to dim the light, which, from the other causes mentioned, is perhaps already far from brilliant. This overflow, it may be remarked, arises from two causes; first, from the excessive inflow of air into the reservoir when once the oil has been consumed to the necessary level; and, secondly, from the heat generated in the immediate vicinity of the reservoir, causing an expansion of air contained within it, and thus forcing down more than the requisite quantity of oil.



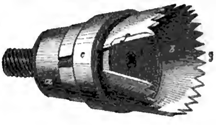
ALLAN'S IMPROVED LAMP FOR RAILWAY CARRIAGES.

The above engraving represents, in section, a dip pipe-fountain lamp, for maintaining the oil in the burner dish at a constant and invariable level, and thus insuring the uniform saturation of the wick, and a steady flame under all circumstances. Also in ventilating the lamp, for the purpose of supplying air to the burner, and for keeping the reservoir cool.

In connection with the lamp fountain is a pneumatic dip pipe, or tube, which is inserted through a filling screw, and descends down the fountain and oil tube, to the level at which it is desired to maintain the oil in the burner dish. There is a counterpoise in this arrangement between the surface of the oil at the bottom of the dip pipe, and the surface of the oil in the burner dish, both parts being subject to the same fluid pressure, and consequently the oil will not rise in the former. Whilst the fountain remains otherwise air-tight the oil may stand in it to any height, and will be disturbed only to the extent of supplying the consumption from the burner dish, but without affecting the equilibrium existing between the burner dish and dip pipe.

Whenever the surface of the oil in the dish falls below the level of the lower end of the dip pipe, the surface also falls below the bottom of the dip pipe, and a bubble of air passes from the latter, and rises to the surface of the oil in the fountain, liberating exactly as much as, and no more than, will restore the true level in the dish; and this action will continue so long as there is waste by burning, and until the oil is exhausted. The top screw is supplied with a leathern washer, for the purpose of keeping it perfectly air-tight.

PRICE'S TOOL FOR CUTTING SHIVES AND CORKS.

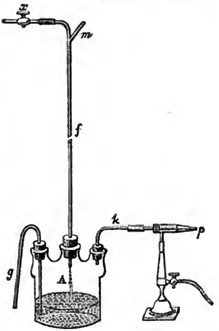


The above engraving represents a perspective view of a tool for cutting shives or other conical blocks, the invention of Mr. W. Price, of the Vauxhall Saw Mills, consists in fixing upon and around a conical mandril *a*, a conical band of steel *b*, which is formed with saw teeth *g*, for cutting shives, and with a knife edge *f*, for cutting cork. The band does not extend round the whole circumference of the mandril, as there is a space left for adjusting the cutter to suit different diameters of shives under operation. The band being retained in its position by a ring *c*, driven over it. The cutting is effected by rotary motion being imparted to the tool by a lathe.

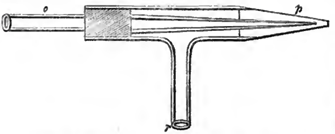
DR. H. SPRENGEL'S LABORATORY BLOWPIPE.

Dr. H. Sprengel has, says the *Chemist and Druggist*, in a recent number of Poggendorff's *Annalen*, described a very convenient blowpipe, which will be found of great use in all laboratories in cities, or other situations where there is an abundant supply of water and of coal gas.

It may be regarded as an admirable and self-acting substitute for the common mouth blowpipe, and may also be employed to heat small crucibles, or for fusing refractory substances.



In the engraving the letter *x* represents a cock, which regulates the supply of water falling down the perpendicular tube *f*, the small branch *m* being a tube of similar diameter, open above, through which air is drawn in, by the descent of the water in *f*. The tube *f* should be from 40 to 60 inches long, and about one-third of an inch in diameter. The mingled stream of water and air passes into the three-necked bottle *A*, the capacity of which should be rather less than a quart. When the mixture reaches the bottle an immediate separation occurs; the water, which in the



first instance collects in the bottom, flows out through the syphon *g*, the diameter of which is equal to that of the tube *f*; the air in the bottle being forced out through the tube *k*, by the pressure caused by the constant descent of water and air through *f*. The current of air flowing through *k* is conveyed to the centre of a flame of coal gas, burning at *p*, from the opening of one of Maugham's burners. The arrangement of the tubes forming the burner is shown more clearly in the enlarged view, where *o* shows the air tube from the bottle, and *r*, the gas tube from the main.

In consequence of the intense heat generated, it is desirable that the tip of the external tube should be formed of platinum, but all the other parts may be of glass or brass. It is necessary that the corks used in connecting the different parts should be very sound and accurately fitted; and great care is requisite in finishing the orifices of the two tubes, as the regular form of the flame depends on their accurate adjustment.

The amount of water required varies with the force with which it is necessary to urge the flame.

THE PROGRESS OF FOREIGN ORDNANCE.

On Monday evening last, Commander A. E. Scott gave an interesting lecture on the progress of foreign ordnance, which he then compared with the progress made at home. He showed that but for the energy of the Emperor Napoleon (who had been taught by being an artillery officer of the Swiss Republic to obtain considerable results with small means), the rifling of the French guns would have probably remained in the same unsatisfactory position as that of our own. That this promptitude enabled the Emperor to bring his rifled field-pieces into his contest with the Austrians, and afterwards, while other nations were still doubting what to do, he had rifled his 30 and 50-pounders, and was again in readiness for the fight.

It was at this critical period of our country's unpreparedness that our noble volunteers rose up in arms obedient to the call of our much loved Queen, and although we have seen the first Englishman of the day—our energetic Prime Minister—order a battery of Whitworth guns on a sufficient scale to efficiently test this plan, yet we are still without good heavy ordnance.

Across the water we have noticed our friends first rifling their field-pieces, and then converting their heavy cast-iron guns into rifles, and further away still, we have observed the Americans with their Parrott gun, which is merely a rifled cast-iron piece strengthened on the Blakely plan.

Much as the present position of the Northern Republic may be criticised, all must admire the energy with which they have set to work in reforming their artillery, bringing, like the French, their field-pieces to one bore, and suppressing, like them, a crowd of calibres.

The Northerners have cast Dahlgren and Columbiad guns from 15 to 11 inches bore, and tested them with perfect success, yet we are boasting of a solitary 10½ bore Armstrong gun, which is too heavy for ordinary use, and may prove too soft, especially about the vent, for continuous firing.

The Italians following the example set by the French Emperor, also suppressed a large variety of calibres, and, after the siege of Gaeta, finally abandoned breech-loaders also, indeed, during the siege, the breech-loading may be said to have abandoned them, as the sterns of several guns blew out in the trenches as well as on board their gunboats.

Commander Scott gave some further information in contrasting the simplicity of the French system with the complications of the Armstrong system, and said that what he had stated in former lectures either as likely to happen or as having happened, had been amply borne out by subsequent failures. Vent pieces of steel, vent pieces of iron, and of a combination of the two had constantly failed, and now solid vent pieces were under trial for the 40-pounder. Shell had broken up in the gun, destroying the grooving, and as for the inner tubes of the gun, the strain of the forced ball was so excessive that over 30, perhaps, 100 tubes had had to be bored out, the 100-pounders being remade. Nor had the 40-pounders stood better, at least half a hundred had first to be strengthened, and they were still failing, and were far from being good guns.

Commander Scott also dwelt upon the absurdity of injuring the solidity of pivot guns by making them breech-loaders, and showed that, besides being liable to get out of order, they were far more exposed to injury from an enemy's shot from having their wings spread out for loading. He also showed that as pivot guns were intended for long ranges, and could be easily got at for loading at the muzzle, the double-wedge apparatus (the newest plan) was a positive disadvantage, for the gun, if elevated for distant firing, had to be placed horizontal before loading.

He touched upon the multiplication of calibres, all different from those of our smooth-bore guns, and shewed the complications which the engineer of rifled ordnance was making for the Navy, as contrasted with the simplicity of the French system, which was to have—

1 calibre for field pieces;
1 calibre for siege guns;
2 calibres for heavy ordnance;

viz., a 30 and 50-pounder, which were rifled so as to throw elongated shells of large capacity for powder or molten iron, and also use all the old ammunition.

Commander Scott referred to the new 70-pounder, which had been spoken of "as a very superior weapon to *even* Sir William's former guns," this, he observed, it might well be without being a good gun, but it really was a totally different piece from any former Armstrong, the groove being much wider, and of an altered shape, the size of bore different, and instead of the usual breech screw, vent piece, and copper breech ring, it had a muzzle swell and a pair of wedges.

But not only were the complications of different descriptions of guns, and different sizes of bores—which would be a dangerous medley for a ship—constantly increasing; but the projectiles and fuses were fast drifting into an equally unsatisfactory state; and as for the cartridges, especially those with the pasteboard cylinders in the centre: sempstresses would be required if they were to be made up in action.

The whole system was, in fact, totally unsuited to actual warfare, and the leaden projectiles which had been made at such vast expense would, like the Indian bullets, be useless after a few year's exposure.

We have not space to follow Commander Scott into his amusing description of the reception of Colonel Treville de Beaulieu by the French Committee, and how, after treating his invention with contempt, and consigning it to the cobwebs, it is to-day the system in use by nearly all European nations; nor can we follow Commander Scott into his account of foreign artillery; but it is worth while noticing that the Austrians, who must be the best judges of Colonel T. Beaulieu's, system from having experienced its effects, have now rifled their field pieces on that plan, and, like most other nations, wisely made the best of their existing "materiel."

WHAT A NAVAL GUN SHOULD BE.

Commander Scott, in his lectures on naval ordnance before the United Service Institution, said a naval gun should

1st. Be simple in its construction,
2nd. Be not liable to injury from blows or weather,
3rd. Fire a shot of large diameter (from 8 to 10 inches or more),
4th. Be able to use the smashing round ball at close quarters,
5th. Give a flat trajectory,
6th. Have projectiles which deflect little, and ricochet straight and evenly,
7th. Fire elongated molten iron shells,
8th. Fire elongated powder shells, near or across ships, &c., with safety,
9th. Fire shrapnel or built-up shells over boats with safety,
10th. Fire canister.

This last is essential for gun-boats to sweep the banks of rivers; a shell cannot replace it for close quarters. A large diameter is included in the above list, for without great size the round ball would have little smashing power, nor could a high velocity be obtained from elongated shot, unless they offered a large area in proportion to length for the powder to act upon, in propelling them. The captivation of the public with long ranges has led to lengthening the projectile at the cost of its efficiency, and has occasioned one great advantage of rifling to be overlooked, viz., the power it confers of shortening the gun without much loss of effect, owing to the detention of the shot and the consequent earlier combustion of the charge. The use of leaded (forced) projectiles, and breech loaders, has even caused a step to be taken in the wrong direction, first by rendering the adoption of a slow-burning powder to lessen the strain on the gun, and then a lengthening of the barrel in order to give the powder time to burn, a necessity.

HARLOW'S FIRE BRIDGES, AND BOILER TUBES.

These improvements in fire bridges or steam boilers, just patented by Mr. R. Harlow, of Heaton Norris, Lancaster, consist in making the same with fire tubes passing through them, arranged as in a multitubular boiler, as illustrated in Figs. 1 and 2 (next page). The fire bridge rests upon cross bearers, supported by a screw jack, the base of which is shaped to fit the bottom of the flue. By means of the jack the top of the fire bridge is screwed up tight against a thick washer inserted between it and the top of the flue, and is thus held in position. Through the washer a water communication is opened between the top of the boiler and the interior of the fire bridge, which by means of a pipe passing from the underside of the bridge through the screw jack is continued into the water space at the bottom of the boiler. The washer is also the means of preserving an open space above the fire bridge for the passage of the flames.

The improvements in tubes for steam boilers consist in making them shaped at one end with a short neck like a bottle, the opposite end being rounded and tapped to receive a screwed tube as shown in Fig 3. These bottle-shaped tubes are to be used as water tubes for placing across boiler flues, and are applied as follows:—The short neck of the said tube is inserted in the boiler through a hole made in the flue, and the tapped hole in the opposite end of the tube is fitted with a small screwed tube, the outer end of which bears against a thick washer, and communicates through a hole in the same (continued through the flue) with the inside of the boiler on the side of the flue opposite to which the short neck is inserted. The tube is then fixed by tightening up the screwed tube, which acts as a jack, and retains it in position.

HARLOW'S FIRE BRIDGES AND BOILER TUBES.

FIG. 1.

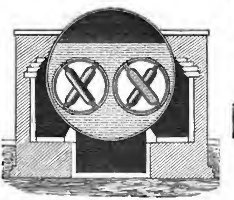


FIG. 2.

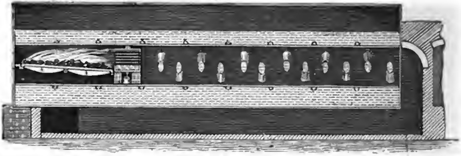
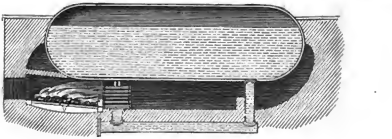
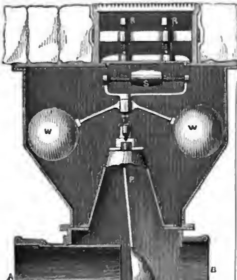


FIG. 3.



REID'S GAS REGULATOR*.

FIG. 1.



PRESSURE regulators for gas have been in use for at least forty years, and, as usually applied, leave little to be desired in point of simplicity of construction or efficiency in action. The ordinary instrument, say for a 12-inch main, may be shortly described, as consisting of a circular iron tank, 3 feet diameter and 3 feet deep, filled with water, and having a sheet-iron gas-holder floating in the water, and capable of rising and falling within the tank. A conical valve is suspended inside the gas-holder, and rises with it under excessive pressure, thereby contracting the inlet passage for the gas, and rendering the pressure and supply nearly uniform. Gas regulators are usually and most conveniently attached to the mains at their issue from the gas-holder; and their regulating influence is found to preserve nearly a uniform statical pressure within the mains for a considerable distance after passing through the instrument. This uniformity ceases at greater distances, when change of level and other disturbing influences come into operation.

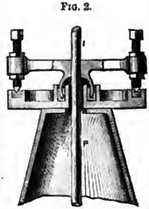
The regulator is intended to correct or modify pressure increasing from elevation, and should be placed—not at the lowest level, where the initial pressure can otherwise be regulated, but on the main pipe, at the first elevation of, say, 100 or 150 feet. At this point it would have the effect of cutting down the accumulated pressure to whatever might be desirable.

The above engravings represent a simple contrivance devised to fit on and form part of the main-pipe, and be sunk with it under the carriage-way to protect it from an injury.

From the necessity of having such an apparatus delicately sensible to the slight and constantly varying fluctuations in pressure, the pendulum movement will be found as being peculiarly applicable; and, if nicely poised on steel centre points, suspended inside a close vessel attached to the main-pipe, and having for its "bob" or weight at the lower end, an iron conical disc valve fitting the orifice of the entrance pipe, it might be so controlled in its vibrations and positions, as to regulate the opening of the gas passage to the extent necessary for attaining the uniform pressure desirable.

A is the entrance pipe, *B* the exit, and *C* the valve; the latter being a circular section of a solid sphere accurately fitting the inner rim of entrance-pipe, and freely moving to or from the orifice, according to the velocity of the stream of gas passing through the instrument. The valve is firmly keyed to the pendulum-rod *P*, and its movements are free from friction. The rod *P* is conducted upwards and outside the valve chamber, the top of which is a truncated cone, and is surmounted with an annular cast-iron cup, as shewn at Fig. 2, containing one inch deep of mercury, into which liquid an inverted cup attached to the pendulum-rod dips its edges, and effectually seals up the gas inside, leaving the pendulum free to move. Over the mercurial cup is a crosshead keyed to the pendulum-rod *P*, at right angles to the plane of vibration, having two finely-pointed vertical steel centres at its extremities, resting on steel pivots level with the mercury. These centres are capable of being adjusted by screw-nuts, and form at once the firm support and fulcra for the pendulum and its appendages.

FIG. 2.



The compound pendulum carrying the weights *W W* overhead prevent any vibration of the valve. These weights require very careful adjustment for working correctly, and their *vis inertia* is found to absorb and destroy the vibratory tendency. The weight *S* is also a portion of the weight so employed above the oscillating centres, and, being mounted on a horizontal screw, is capable of being moved to the right or left, so as to produce the desired check on the current of gas impinging on the valve *C*.

The action of the regulator may be thus stated. As the pressure of resistance on the back or outside of the valve is diminished in proportion to the rate of consumption from the mains, the yielding valve gradually moves from and enlarges the orifice of the gas passage, and *vice versa*, in a manner not unlike the action of the well-known Arnott ventilator.

REID'S WATER REGULATOR.

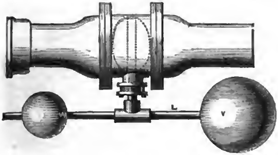
THIS instrument resembles the foregoing in its purpose, and is submitted as a design or suggestion of a principle, on which the delivery of water through street mains might be subjected to control, keeping in view the difference in the nature of the fluids, the one elastic and pliable, the other non-elastic and possessing physical characteristics when under head pressure, which render it difficult to curb.

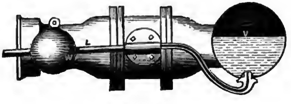
The instrument is affixed to the main-pipe at a point where it may be desirable to reduce the volume of water flowing towards a lower locality. An ordinary throttle-valve is inserted between the flange joints of the water main. The valve and lining of the valve-block are made of brass. It being desired to check the flow of water passing the valve, the latter should have its degree of opening at all times proportioned to the quantity of liquid required to flow through, and diminish or enlarge in area correspondingly. For this purpose a lever, as shewn in the annexed engraving, is fitted to the projecting end of the valve-spindle,

---

* From the *Transactions* of the Royal Scottish Society, 1861.

REID'S WATER REGULATOR.





carrying a hollow copper vessel *V* at one end, and a solid iron weight *W* at the other extremity.

The valve-spindle and lever *L* are hollow tubes, forming a communication between the copper ball and the water within the pipe. The compression of the air by the water pressure will allow a certain portion of water to enter the copper vessel, the weight of which will shut the throttle-valve. The counterpoise weight *W* is then adjusted to give the requisite degree of opening to the throttle-valve for the passage of the water, and the machine is in working order.

The pressure on the volume of air confined inside the air-vessel will diminish its bulk in the ratio of one-half, one-third, one-fourth, &c., as the atmospheres of pressure increase in the order two, three, four, &c. The mechanical agency thus derivable from the fluctuations of pressure within the pipe—increasing or diminishing the gravitating force of the hollow ball—is, therefore, proposed by me to be employed in this or a similar manner for more effectually equalising the distribution of the supply of water to large towns.

PLATT AND RICHARDSON'S IMPROVEMENTS IN COTTON GINS.

This invention, by Messrs. Platt & Richardson, of Oldham, relates to that description of machine known as the "roller gin," and consists in certain additions thereto, whereby the material is regularly supplied to the action of the rollers, and presented thereto in a more open and suitable condition for the separation of seeds.

In the accompanying engraving, Fig. 1 represents in section the operating parts of a two roller gin constructed according to these improvements, and Fig. 2 is a plan. The framework which carries what may be called the head of the machine, embracing the operating parts, and the usual rollers, by which the seeds are separated from the cotton. Behind these are other rollers armed with teeth, so as to constitute rotatory combs, which rollers are situate above an endless feed apron, formed by a belt, on which are fixed transverse strips of wood, a part of which strips only are shewn in the engravings. Between the ordinary rollers and comb rollers is placed a shaft, upon which are mounted a series of hooks or combs, this shaft is provided with a lever, to which is jointed a rod connected at its lower end to a crank, fixed to the axis of the roller by this means, therefore, the shaft is caused to turn in its bearings, and the hooks or combs are made to vibrate between the ordinary rollers and the comb roller. Beneath the vibrating combs or hooks and roller is placed a dish, which at the end towards the rollers is formed as a grating.

PLATT AND RICHARDSON'S IMPROVEMENTS IN COTTON GINS.

Fig. 1.

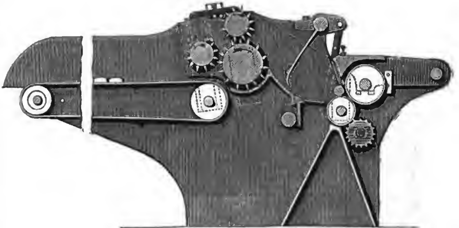
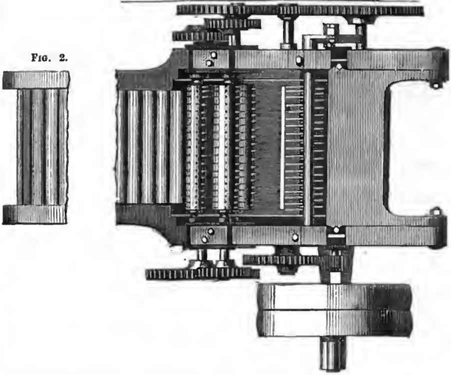


Fig. 2.



Proceedings of Societies.

SOCIETY OF ARTS.

On Wednesday, the 15th inst., Mr. Blanchard Jerrold read a paper before the Society of Arts, on a "Comparison of the year 1851 with the year 1861." We consider the paper a poor one. It scarcely glanced at the amazing progress which science, art, and manufactures had made during the last ten years. Mr. Jerrold's deficiencies were, however, well supplied by Mr. P. L. Simmonds, in the discussion. Mr. Simmonds said:—"We had recently been taking a census of our home population, and many of our possessions had also been enumerating their people, and making even a more careful analysis of their natural and social condition than ourselves. The present, therefore, offered a fitting opportunity for forming some kind of rough estimate of the present and the past. Firstly, what had been the progress of art in the past decade. There had been one special representation of Fine Art Treasures at Manchester, which had been a great success but the collection, illustrating modern art, which would be exhibited from all quarters of the world this year, as compared with the works of the past, would be the best answer to the inquiry. It would be found that painting, sculpture, photography, and art education had greatly advanced. If we passed next to manufactures—in which we as a nation chiefly excelled—how striking and prominent were the advances which we had made, although in a few branches the Continental nations were competing creditably with us. Take, for instance, our mining industry—the production of coal had risen to nearly 70 million tons, and the exports of coal had trebled. The value of the machinery and mill-work exported had risen from 1 to 4 millions. The production of iron had risen from 2½ to 3½ million tons, and the value of our exports of iron and iron manufactures in various shapes, had increased from 8½ millions sterling to 21½ millions. The advance in our textile manufactures in the period under review has been enormous. Independent of the immense home consumption by our well-clothed population, the value of the exports of textiles has risen from 44½ to 77 millions. Cotton manufactures alone have advanced from 30 to 52 millions; and Great Britain now supplies cotton goods to the population of the globe to the extent of about 1s. 3d. per head. Woollen manufactures exported have risen from an aggregate of 1½ millions to 4 millions sterling, and would have increased to even a greater extent but for a want of larger supplies of the raw material, especially of long stapled lustrous wools suited to the worsted manufacture. Our African and Australian colonies had hitherto confined themselves to the production of fine merino wools, but the high price realised for long wools would, ere long, stimulate the more extensive production of that quality in localities suited to it. Looking only at our foreign trade, we should find that between 1851 and 1861 our external commerce, and of consequence, the shipping employed in the carrying trade, had nearly doubled. And for much of this we were largely indebted, as he had shown on a former occasion, to the increase in our steam marine. We were now possessed of 700 or 800 more steamers than we owned in 1851, and these registered double the amount of tonnage. We had also built and registered in the ten years 16,300 merchant vessels, measuring three and a half million tons. The improvement in the social condition of the country was also very remarkable. The people were better fed, better housed, better clothed, better educated, possessed more comforts, and generally received better wages. There had been a very large reduction of taxation. The glass and window duty, soap, newspaper stamp, paper, timber, tea, sugar, fruit, and various other minor customs and excise duties, had either been wholly repealed or much reduced. And though the annual revenue raised had been increased by about twenty millions, yet there were causes for this owing to the position of foreign affars, which were not likely to be permanent, and a diminution of the national expenditure, especially hereafter, on our naval defences, would, doubtless, lead to a further reduction of taxation. There was a feature in our social improvements which ought not to be passed over without notice, and that was the great increase of postal facilities, which had so largely swelled the correspondence of the country, increasing the letters delivered from 327 to 564 millions. The number of post-offices had been largely increased, and in the metropolis there was not a house a furlong from a letter-box. The money orders had been extended to the colonies, and the number and amount transmitted had nearly doubled in the ten years. The book-post and the Post-office Savings Banks were other conveniences, whilst the foreign postal rate had been largely reduced, and the means of communication been rendered more regular, speedy, and convenient, greatly to the interests of commerce. If we turned to agriculture, great and manifold improvements had been made in the cultivation of the soil and in the harvesting of crops, by cheaper and improved artificial manures and agricultural implements, whilst the latest improvement was the harnessing of steam to the plough. Chemistry, again, had achieved wonders in the discovery and useful application of new dyes, the products of coal, the manufacture of aluminium, &c. If they looked even around them in the great metropolis, they would see much indicative of startling progress made in the past ten years, although occurring progressively under their very eyes. These improvements were likely to be overlooked. Need he allude to the new bridges, streets, railway termini, hotels, and hospitals, the Crystal Palace, South Kensington Museum, Museum of Economic Geology, and other similar buildings and institutions. Looking abroad it would be found that the position of foreign countries had been materially altered for the better—their political and social condition and commerce had greatly improved. We had concluded many new and important commercial treaties. He had shown the members, in a recent paper, how largely all foreign countries intended to compete in the forthcoming Exhibition, whether from the far East, South America, and even from Central Africa; but one of the latest announced exhibitors was the King of Madagascar, while he had even heard that the King and Queen of the Sandwich Islands contemplated coming over to visit the Exhibition. With regard to the British Colonies, it was not necessary that he should do more than state that their position in 1851 and 1861 was widely different. Then not more than ten or twelve colonies took part in the display, and some of those in a very imperfect manner; now there would be scarcely three or four out of the 50 British possessions unrepresented, and these had gone in energetically, by the votes of large sums and by creditable personal exertions, to do their best to stand well in the eyes of the visitors. Especially would our great Australian possessions, which have added half a million of people to their population in the ten years, stand out prominently in the Colonial Courts of the Exhibition. Their material progress had been remarkable, and not a little aided by the enormous amount of gold there discovered and thrown upon the world. The colony of Victoria intended to send a gilded pyramid rising forty feet, on a base ten feet square, as a representation of the 800 tons of gold that had been found there in the last ten years. But the gold discovered in the other Australian colonies would probably make up an amount of 200 tons more, whilst we should have supplementary exhibits from the rich gold fields of British Columbia, Nova Scotia, and elsewhere. These gold discoveries might almost all be comprised within the last ten years under notice, and had enabled us to add to our gold coinage 56 millions sterling, besides the large amount put into circulation in Europe and America, and the Colonies themselves. 240 millions might safely be assumed as the aggregate value of the gold discovered in that period. The increased entries and clearances of sailing vessels and steamers was fully 75 per cent. in excess of those of 1851.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, Jan. 7.—Edward Schunck, Ph.D., F.R.S., Vice-President, in the chair.

Prof. Dr. Johannes Gistel, of Kempten, in Bavaria; Federico Lancia di Brelo, Inspector of Studies in the University of Palermo; and James Nasmyth, Esq., C.E., were elected corresponding members of the society.

A paper was read by J. P. Joule, LL.D., President, entitled, "Experiments on some Amalgams."

The weakness of the affinity which holds the constituents of amalgams in combination seemed to the author to offer the means of studying the relationship between chemical and mechanical force. His inquiries were extended to several amalgams, and gave results of which the following is a summary:—

Amalgam of iron was formed by precipitating iron on mercury electrolytically. The solid amalgam containing the largest quantity of mercury appeared to be a binary compound. Iron does not appear to lose any of its magnetic virtue in consequence of its combination with mercury. Its amalgamation has the affect of making it negative with respect to iron in the electro-chemical series. The affinity between mercury and iron is so feeble, that the amalgam is speedily decomposed when left undisturbed, and almost immediately when agitated. The application of a pressure of fifty tons to the square inch drives out so much mercury as to leave only thirty per cent. of it in the resulting button.

Amalgam of copper. By precipitating copper on mercury electrolytically, a mass of crystals is gradually formed. After a certain time the crystals begin to get fringed with pink, indicating uncombined copper. In this state the amalgam is found to be nearly a binary compound. On applying strong pressure to an amalgam containing excess of mercury, the latter is driven off, leaving a hard mass composed of equivalents of the metals. If, however, the pressure be continued for a long time, the resulting amalgam contains more than one equivalent of copper, indicating a partial decomposition.

The author gave an account of his experiments with amalgams of silver, platinum, lead, zinc, and tin. In the case of the latter amalgam, long-continued pressure drives off nearly the whole of the mercury, indicating in a striking manner the efficacy of mechanical means to overcome feeble chemical affinities.

Dr. Angus Smith said, It is difficult to tell the exact limits of chemical and mechanical action, because they flow into each other. Let us call the attraction of surfaces a mechanical action, as it is not to our knowledge a chemical combination. Porous bodies exercise this to a very large extent, and yet do not produce chemical compounds. The amount is limited on one side by the pressure of the atmosphere. Chemical compounds are too powerful to be affected by such slight forces. Porous bodies or surfaces do not take up others in chemical equivalents so far as we know; the full capacity of saturation is not satisfied, because of counteracting influences. Water admits air very rapidly, but it is held so slightly that it is affected by atmospheric pressure, and even seems to follow exactly the atmospheric pressure; but a portion is held with such power that it is extremely difficult to remove, and is not ever removable by the mere removal of pressure, as far as we know. The small affinity of the great mass or surface of water is equal to a great affinity for a small amount of air. All masses have more or less this mechanical action, but, as in the case of porous bodies, the attraction is feeble, and not raised into the power of a definite grasp of a given quantity, such as an equivalent, which is the case with a powerful affinity forming a chemical compound. Large and watery masses lose their water slowly by the mere force of gravitation. Strong mechanical action rises to an equality with feeble chemical affinity. Weak chemical affinity sinks into an equality with mechanical action. Charcoal absorbs gases more eagerly under pressure, but by a removal of pressure they are still absorbed; so that the mechanical force is greater than the weight of the atmosphere can control. There are many cases in which these two forces, if they be two, meet. This of the mercury and other metal is one case. The feeble chemical affinity is, I suppose, overcome by the powerful mechanical force. The alloy with sufficient chemical affinity remains, that with a weak affinity separates. The mercury flows off, following the law of liquids; in like cases it flows off like water flowing slowly from a moist porous mass like wet clay. Instances from the feeblest to the most powerful affinity might be given, showing that only when the power reached a definite point, did the law of chemical equivalents come in. At the same time there is a definite point where surface action ceases under certain conditions.

These ideas have arisen partly from experiments on the subject, which may some day be published. I believe they explain the difficulties attending the attraction of masses which seem occasionally to oppose the combination by atomic weights.

A paper was read "On the Conductibility of Heat by Amalgams," by Dr. F. Crace Calvert, F.R.S., and Mr. Richard Johnson.

The method followed in the investigations described in this paper is the same as that detailed in their former paper on the conductibility of metals and alloys.

THE CHEMICAL SOCIETY.

ON THE COMPOSITION OF A CARBONACEOUS SUBSTANCE EXISTING IN GREY CAST IRON.

By F. Crace Calvert, F.R.S., F.C.S.

Having often noticed that the quantity of carbonaceous mass left in the vessels in which grey cast iron was dissolved, varied with the concentration of the acid used, I began in September, 1858, a series of experiments on the action of very weak acids on cast iron, in the hope of obtaining a quantity of the so-called graphite which it contains, and I believe that I have arrived at results which throw much light upon the chemical composition of this substance, proving it to be composed of iron, carbon, nitrogen, and silicium. This substance occupies exactly the same volume as the cast iron from which it is obtained, and is sufficiently soft to be easily penetrated by a blade. I shall now describe the method of experimenting.

Cubes, of one centimetre in dimension, of Staffordshire cold-blast cast iron were placed in corked bottles with eighty times their volume of the following weak acid solutions;—

Sulphuric acid,	1	alkalimeter	contained	10	grs. of	SO_3 anhydrous.
Nitric ,,	1	,,		13·5	,,	NO_5 ,,
Hydrochloric	1	,,		9·12	,,	HCl ,,
Acetic ,,	1	,,		12·75	,,	$C_4H_3O_3$,,
Oxalic ,,	1	,,		9·00	,,	C_2O_3 ,,
Tartaric ,,	1	,,		33·00	,,	$C_8H_4O_{10}$,,
Gallic ,,	1	,,		10·00	,,	cryst. acid.

The foregoing figures represent the equivalent quantity of anhydrous acid as compared with 10 grains of anhydrous sulphuric acid per alkalimeter.

Besides the above, phosphoric, carbonic, oleic acid, tannin, and acid peat-water were also used.

After three months of contact, I found that, although the external appearance of the cubes was not changed in any of the vessels, still those in contact with the weak sulphuric, hydrochloric, and acetic acid solutions, especially the latter, had become so soft externally that the blade could penetrate three or four millimetres into the cubes. I, therefore, removed the solutions from the vessels, and replaced them by an equal bulk of each weak acid solution, and continued to do so every month for two years. I then found that the cubes in contact with the acetic acid ceased to yield iron to the acid, although they were still of the original size; they had, therefore become transformed into the carbonaceous substance before mentioned. These are the results of the action of the various weak acid solutions on the centimetre cubes of grey cast iron, after two years:—

Acetic acid .	. Complete.
Hydrochloric acid.	. Nearly complete.
Sulphuric acid.	. Ditto ditto.
Nitric acid .	. Action less complete than above.
Phosphoric acid	. No similar action.
Oxalic acid .	. Ditto.
Tartaric acid.	. Ditto.
Tannin . .	. Very slight action.
Carbonic acid	. Ditto.
Gallic acid .	. Ditto.
Oleic acid .	. Ditto.
Acid peat-water	. No similar action.

The action of acetic acid on grey cast iron is most interesting; for instead of ceasing when saturated with oxide of iron, as is the case with other acids, its action is continuous, if the precaution is taken to close the mouth of the vessel with an ordinary cork. Thus I have had cubes of cast iron in contact with the same quantity of acetic acid for two years, and the chemical action still existed when the contents of the bottles were examined. This action of acetic acid appears, therefore, to be analogous to that which it has on lead.

To examine the chemical composition of the cubes transformed by the action of acetic acid, they were reduced to fine powder in an agate mortar, and well washed with boiled water slightly acidulated with acetic acid. The powder was then dried at 115° C., in a dry atmosphere of carbonic acid or hydrogen, according to the nature of the body to be determined in the mass. The carbonaceous substance so prepared presented the following properties and composition:—

The cubes of grey cast iron, which originally weighed 15·324 grammes weighed only 3·452 at the end of the two years, and their specific gravity was reduced from 7·858 to 2·751. Their composition was as follows:—

	Composition of the original cubes.	Composition of the carbonaceous substance.
Iron	95·413	79·960
Carbon . . .	2·900	11·020
Nitrogen . .	0·790	2·590
Silicium . .	0·478	6·070
Phosphorus .	0·132	0·052
Sulphur . .	0·179	0·096
Lost	0·108	0·205
	100·000	100·000

These results lead to the following remarks:—

Nitrogen.—That the largest part of the nitrogen originally existing in the cast iron remains in the graphitoid substance, and only a small portion is transformed into ammonia. These facts tend to prove that the nitrogen of cast iron exists in it under two states, namely, that one portion is combined with the carbon, whilst the other is in a condition to unite with the hydrogen liberated from the water, and thus to form ammonia. This method of ascertaining the amount of nitrogen in cast iron, by determining the quantity of nitrogen in the state of ammonia, and that existing in the carbonaceous mass, appears to be the very best process known, for I obtained 0·790 from the same cast iron which only yielded me 0·100 by the process lately published by M. Fremy. For ordinary analyses of cast iron, the slow action of acetic acid may be advantageously replaced by that of hydrochloric acid, taking care to use freshly distilled acid, water free from ammonia, and placing the whole in a flask provided with cork and tube, so as to exclude the possibility of the ammonia existing in the atmosphere from interfering with the experiment. By this means the amount of nitrogen existing in cast iron can be easily and speedily ascertained.

Silicium.—I have ascertained by direct experiments that it is silicium, and not silica, that enters into the composition of the carbonaceous mass. Amongst other experiments I may state that I took 5.96 grains of the carbonaceous substance dried at 115°C. in a current of carbonic acid, and after having placed it in a small platinum dish, the whole was introduced into a procelain tube, and submitted for several hours at a red heat to a current of pure and dry oxygen. I then found that the 5·96 grains had increased to 7·39 grains, or nearly the theoretical amount: for 5·96 grains of substance would lose 0·664 of carbon, and the remaining 0·338 of silicium would become 0·718 of silica, whilst the 4·672 of iron would become 6·702 of peroxide of iron, or both added together 7·420, being within 0·13 grain of the weight actually found. Now, if the iron in the mass had been in the state of protoxide, and the silicium in the state of silica, the 5·96 grains employed would, after the loss of carbon, have decreased to 5·551 grains, leaving, therefore, no doubt that the carbonaceous substance contained metallic iron and silicium. Finding, however, that the quantity of silicium in the carbonaceous substance, though high, did not represent the whole of the silicium contained in the cast iron employed, I passed the hydrogen, liberated by the action of weak acids on cast iron, through fuming nitric acid, and found, on the evaporation of this acid, a white deposit of silica. All acids which give off hydrogen when in contact with cast iron, also give rise to the gas discovered by Wöhler, namely, silicide of hydrogen.

Carbon.—Like silicium, the quantity of carbon found in the carbonaceous compound does not represent the whole of the carbon pre-existing in the cast iron employed, as carburetted hydrogene are given off during the slow action of acetic acid on cast iron.*

Iron.—As shown by the above analysis, the carbonaceous compound contains 79·960 of metallic iron, even when the acetic acid has ceased to act upon it. I have made several experiments to satisfy my mind that the carbonaceous mass contains metallic iron, and not oxide of iron. Thus, I passed hydrogen, at a dull-red heat, over some of the carbonaceous substance previously dried at 115°, and obtained no water, and the experiment related under the head of silicium confirms this conclusion. All grey cast irons appear to yield the same relative proportions of carbon and iron; but as cast iron becomes harder and whiter, the amount of carbon decreases, and in fact, nearly disappears in Welsh white cinder iron, being replaced by silicium. The relative amount of carbon and iron in the carbonaceous substance corresponds to 4C and 6Fe, or are the same that I have found in some cast iron which had been saturated with carbon, by melting No. 1 cast iron in presence of a large excess of coke on a cupola, and called technically "keechy."

I do not, however, believe that the carbonaceous substance obtained by me is simply composed of 4C and 6Fe, but that the nitrogen and silicium found in it must likewise enter into its composition. But, in the present state of my researches, it would be premature to attempt to assign any definite composition to this substance. As I am, however, still pursuing the subject, I shall be happy, if I arrive at any conclusion, to communicate the same to the Society.

When the *graphitoid* substance prepared by the above process, is exposed to the atmosphere, it absorbs oxygen with rapidity, and the temperature of the mass rises rapidly, protoxide of iron being first formed, which is converted into sesqui-oxide; but when this mass is placed in distilled water, a chemical action ensues similar to that described by M. Kuhlmann, namely, a portion of the carbon is converted into carbonic acid by the oxygen of the sesqui-oxide of iron, and the carbonic acid thus produced unites with protoxide of iron to form carbonate of protoxide of iron. The atmospheric action on the carbonaceous substance above described, explains the difference of composition which I have found to exist between the body obtained by me, and that of a soft graphitoid mass which was found to replace a mass of iron buried for many years amongst coal cinders, and which had the following composition:—

Mean of several Analyses.

Peroxide of iron.	66·61
Carbon	12·03
Silica	18·13
Sulphur	0·79
Phosphorus.	traces
Lime	2·14
	99·70

Nitrogen was also present, but its amount was not determined. I am aware that the latter curious and interesting change in cast iron has been several times noticed. Thus, Dr. Henry published a short notice on this subject in the "Annals of Philosophy." Mr. R. Mallet also described a similar substance in the "Transactions of the British Association." Mr. Warington has also noticed the conversion of cast iron into a soft black substance, which occurred in a brewery where it was in contact with sour beer. Lastly, Mr. E. W. Binney records, in the 11th volume of the "Memoirs of the Manchester Philosophical Society," a description of a similar substance found by him at the emptying of a deep coal-pit, in which the cast iron had remained submerged for a few years, and which yielded to Dr. Angus Smith the following composition:—

Iron and bases	38·8
Carbon	40·0
Silica	19·7
	98·5

In conclusion, the conversion of the guns of the Royal George, at Spithead, is so well known, that I merely refer to it to express the same opinion as Mr. Binney,—that it strongly behoves those who have charge of lighthouses, now so often erected in the sea upon cast-iron pillars, to carefully and frequently inspect such structures, for day by day their support must be weakened by the action of the salt-water. (See Memoirs of Manchester Philosophical Society, Vol. II., page 28.)

MEETINGS FOR THE WEEK.

MON.—*London Inst.*, "On Arts, Manners, and Customs of Japan," by D. J. Macgowan, M.D., at 7. p.m.

TUES.—*Inst. Civil Engineers*, "On the Form and Materials for Iron-plated Ships, and the Points requiring attention in their construction," by J. D'A. Samuda, Esq., at 8 p.m.
Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., F.R.S., at 3 p.m.

WED.—*Society of Arts*, "On some recently executed Deep Wells and Borings," by G. R. Burnett, Esq., C.E., at 8 p.m.
Geographical Soc., I. "Journey in Eastern Africa from Mombas to Kiléma, and Ascent of Kilimanjaro," by R. Thornton, Esq., communicated by Sir R. Murchison. II. "Ascent of the Ogun or Abbeokuta River, W. Africa," by Capt. R. F. Burton, F.R.G.S., H.M.'s Consul at Fernando Po, with Capt. N. B. Bedingfield, R.N., F.R.G.S., and Dr. Eales, R.N., H.M.S. Prometheus. III. "Proceedings of the Boats of H.M.S. Bloodhound up the River Volta, W. Coast of Africa, under Lieut.-Com. W. D. Markworth Dolben, R.N., at 8.30 p.m.
London Inst., "On the Geological and Geographical Distribution of Organized Beings," by E. W. Brayley, Esq., at 7 p.m.

THUR.—*Royal Soc.*, at 8.30 p.m.
Antiquaries, at 8.30 p.m.
Royal Inst., "On the Generation of Heat by Mechanical Action," by John Tyndall, Esq., F.R.S., at 3 p.m.

FRI.—*United Service Inst.*, "An Outline of Studies recommended to a Young Officer," by Col. W. Dixon, R.A., at 3 p.m.
Royal Inst., "On the Theories of the Motions of Glaciers," by W. Hopkins, Esq., F.R.S., at 9 p.m.

SAT.—*Royal Inst.*, "On the English Language," by Rev. A. J. D'Orsey, B.D., at 3 p.m.

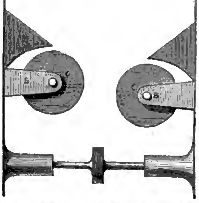
Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

A NEW RAILWAY CARRIAGE BUFFER.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I now transmit to you an elevation of my method of preventing railway collisions. The letter *C* indicates cylinders or rollers, which should not be upon the same level, and, by means of very strong rods, loosely be fixed into the bearers *B*. Above each of the cylinders a framework should be placed, as shown, and below them buffers of the ordinary kind should have their place.



The cylinders should come into contact with the bearers as shown, for the purpose of rendering a greater force necessary to remove them from their position. If made much smaller than in the proportion indicated, they either would not, or would not readily, rotate upon coming into contact, in consequence of the counteracting molecular vibrations which would in this case be produced, which would destroy the efficiency of the apparatus. I may here also observe, that without this invention it would be an improvement if the springs of ordinary buffers were made stronger than they are, and this inasmuch as in every case of collision, where the bodies are moved only by their own momentum, the greater resistance would be of extreme service.

---

* I am now engaged in preparing a sufficient quantity of these hydrocarbons to enable me to submit them to a careful examination.

I am, Sir, yours faithfully,
J. ALEXANDER DAVIES.

January 21, 1862.

◆

NAVAL ORDNANCE.

SIR,—In that very instructive lecture given by Commander Scott, at the last Session of the Royal United Service Institution, which you quote in your number of yesterday, is the following passage:—"The adoption of iron shot would likewise admit of the use of what promises to be a formidable means of offence, viz., a flat-headed shot, with a powder shell, having a percussion fuze in its rear. Such a shell, if fired from a powerful gun, would penetrate the armour plate, and then discharge its mine in the side of an opponent." I would prefer to the above described shell, one formed on the model of the elongated flat-headed steel shot, which, fired from the two-groove military rifle at Cork, during the time of the meeting of the National Association for the Encouragement of the Arts and Sciences, held there in 1852, pierced a boiler plate of tough Russian iron, three-eighths of an inch thick, at the distance of sixty yards, which is already reported by Colonel Beamish, one of the council present, in his letter to the *Times*, and to the editor of the *United Service Journal*, August, 1852. I would have the flat front of this steel bolt drilled about ten inches in its centre, the diameter of this chamber to be from one to two inches, and to be charged with liquid fire, phosphorus dissolved in bisulphide of carbon, which, when it spontaneously ignites, water cannot extinguish. I have repeatedly discharged such shot and shells, having studs of lancewood in them suited to the four grooves of my one-pounder rifle brass cannon, which was rifled for me at Woolwich, *twenty* years ago, by order of the then Master General of the Ordnance, drawings of such shot and shells appear in the back numbers of your valuable magazine. J. NORTON.

◆

THE ACCURACY OF FLIGHT OF PROJECTILES.

SIR,—At the conclusion of some remarks on projectiles, which you did me the honour to publish in the MECHANICS' MAGAZINE about five years ago, I stated as my opinion, that, with a smooth barrel of perfect proportion, and projectiles of corresponding perfection, there might be reached an accuracy of flight equal to, if not greater than, what is obtained by firing the projectiles from rifled barrels. Knowing that there are, amongst your readers, many men of eminent mechanical science and skill; and believing that lately the almost universal desire for perfecting *rifled* firearms may in some way have diverted an amount of attention, that might have been bestowed with advantage upon the perfecting of smooth-bore firearms; finding moreover, that, of rifled weapons, those appear to be the most efficient whose form of rifling makes them approach nearest to smooth barrels; I beg once more to draw attention to the subject, and to suggest that, notwithstanding our knowledge in circular geometry is as yet not quite perfect, the attempts to improve smooth barrels should not be discontinued, and more especially not in the case of barrels of larger size—of cannon barrels—which might more easily be constructed of comparatively greater perfection than those of small arms.

The action of the propelling gases in firearms may perhaps be fitly compared to that of powerful steel springs, whose effect in hurling off projectiles is greatest in proportion as the retaining resistance is proportionately strong and the release sudden; and if there could be constructed a smooth barrel of almost mathematical perfection, and of a *very slightly* conical shape, with the base of the cone at the breech, and if there were employed projectiles consisting of substances that admit of contraction during discharge,—shape of barrel, and substance of projectile combining to offer to the expansion a similar, but more uniform and less jerking resistance than is offered by the grooves of rifled arms,—then I believe the results will be such, that *rifled* firearms will soon be looked upon as poor make-shifts of former times. The greater accuracy sought to be obtained in rifles, by the spinning motion of the projectiles, is obtained in our smooth bore by greater accuracy of form and proper balance of flight, so that the projectile of the latter would not rush with a spiral coil of air wrapped round it, but more with the smooth flight of an arrow.

I am, Sir, yours respectfully,
G. J. G.

Spain, January 11, 1862.

Scientific Gossip.

W. C. wishes room for the following:—"There is a great deal of nonsense just now talked about the stone fleet, with which the Federals have blocked up Charleston harbour. In the first place, I do not see much difference in blocking up a harbour or in battering down a city. But then, it is said, you can rebuild the demolished city, but you cannot clear the harbour again. This is a mistake. The engineering science of this age has done much more difficult things than clearing Charleston harbour of a stone fleet. I have no hesitation in affirming that there are engineers in this country who could make the harbour as good and as useful as ever in a week. Certainly, the man who in a few weeks removed the rocky obstruction, not broken rocks and boulders, but of the solid primitive formation of "Hell-gate," and "Diamond-reef," in New York bay, would not fear the difficulty in reopening the channel at Charleston. To my mind, destroying thousands of valuable human lives is a far more reprehensible thing than temporarily blocking up a harbour." W. C., however, does not inform us how the sunken whalers, with their cargoes of granite rocks, are to be so easily removed.

INSTANTANEOUS PHOTOGRAPHY.—We have recently seen beautiful stereoscopic views of London streets, with their moving life accurately depicted. The first attempts of the kind had about them the cold grey early morning air, which gave them the appearance of being views of cities of the dead. Owing to the time the plate was exposed to the light, moving life in those attempts was impossible of depiction. This difficulty, in the pictures before us, has been overcome, as the instantaneous exposure of the plates has been sufficient to fix every living thing upon them. There are also in the series some lovely views of the sea, which are so natural that one can see the glistening of the water in the rays of the sun. These are perfect studies, and bear the stamp of a genuine artistic finish. Some fine illustrations are "Sunset at Ryde," "Sunset at Greenhithe," and "A Study of Clouds at Southsea." Amongst the views in London we may name as perfect pictures, "The National Gallery from the Strand," "Hungerford Bridge," "The Royal Exchange," and "Trafalgar Square." The whole series, numbering upwards of one hundred, are marks of the advancement of photographic art in its most pleasing phase, and reflect credit on the publisher, Mr. C. E. Elliott, of Aldermanbury Postern. The motto, from Cowper, which is attached to the views of London, is extremely apt:—

> "'Tis pleasant through the loop-holes of retreat,
> To peep at such a world, to see the stir
> Of the great Babel, and not feel the crowd."

For some weeks past we have been expecting to see in the *Times* Captain Halsted's letter in answer to Sir William Armstrong. It would be remarkable if Captain Halsted has not written to the *Times*, and it would be equally remarkable if the letter had been sent and not inserted. Possibly, the answer was sent to the *Times* during the period when a war between this country and America was imminent. If so, there might have been a reason for suppressing the letter. But the probability of a war having for the time passed away, the Armstrong gun controversy may, with advantage, be resumed. We should, therefore, be glad to hear what Captain Halsted has to say.

King Frost occasionally plays pranks with the strongest iron. An instance occurred at the Ordnance Wharf, Chatham, on Saturday last. When working a large steam crane, a massive chain, used in lifting a 10-inch gun, weighing 95 cwt., suddenly snapped. The chain a few days before sustained double the weight.

MONSTER GUN.—The 300-pounder Armstrong gun, manufactured at the Elswick Factory, on the muzzle-loading principle, was on Monday fitted to a carriage, constructed at the Royal Arsenal, and the extraordinary weapon, which weighs 12 tons 8 cwt., will be tested at Shoeburyness, when the necessary ammunition is prepared for that purpose.

ELECTRIC PRODUCTION OF HYDRATES OF SILEX AND ALUMINA.—M. Becquerel, who for the last thirty years has been occupied with researches with the object of reproducing the minerals and crystals of nature by electric decompositions and recompositions by feeble currents, has submitted to the French Academy some important results obtained by substituting intense currents at a high tension. The two first substances acted upon were the silicate and aluminate of potash. The conditions of success are—absolute purity of the matter submitted to electrolysis, a determined strength of the solution, and a determined intensity of the current. For details we must refer to the *Comptes Rendus*. From silicate of potash M. Becquerel has produced beautiful opals, hydrophanes, and other crystals, endowed with all the qualities of those found in nature. From the sulphate of ammonia he has obtained a hydrate of ammonia identical with diopside; and he does not despair of obtaining from the hydrate of ammonia the topaz, corindum, and sapphire.

COAL TAR TO PREVENT THE POTATO DISEASE.—M. Lemaire (*Comptes Rendus*, T. liii. p. 1074) mixed two per cent. of coal tar with earth, scattered the mixture over his ground, dug it in eight inches deep, and then planted his potatoes. None of those protected by tar showed any sign of the disease, while more than half of some planted at a short distance on the same day, and left unprotected, were found to be diseased.

USE OF BARYTA SALTS IN DYEING AND PRINTING.—Frightened at the prospect of manufacturers being some day hard up for potash, M. Kuhlmann proposes (*Comptes Rendus*, T. liii. p. 1047) to economise its use immediately by substituting baryta salts for the corresponding potash salts employed in dyeing and printing, *e.g.*, the tartrate, chromate, and ferrocyanide. So far he seems to have tried only the tartrate of baryta, which appears to replace tartrate of potash successfully; but M. Kuhlmann is always a little mysterious.

RESISTANCE OF STARCH ON COTTON TISSUE TO SOLVENTS.—Chevreul (*Comptes Rendus*, T. liii. p. 984) boiled a cotton fabric impregnated with starch in distilled water for two hours, then soaked it in water and hydrochloric acid for eighteen hours, afterwards washed it with common water and then in distilled water; and after all this, the cotton contained enough starch to be coloured blue with iodine.

A GIGANTIC SCHEME.—We understand that parties are now in Washington, representing large European and American interests, urging upon government the necessity of constructing a ship-canal between Lake Erie and Lake Michigan. They look to the state of New-York to widen and deepen its great canal, and to the state of Illinois to enlarge its canal, so that vessels may be loaded, according to their theory, nine months of the year on the Mississippi and discharged on the Hudson. It is asserted that by the time the canal could be completed should the government enter at once upon the project, the productions of the West would swell vastly beyond their present dimensions, and give to the country great additional resources for an exchange of products for the staples and manufactures of Europe. The canal between the two points would be about 160 miles long; the Illinois canal is 100 miles. The connection with the Mississippi River would be at Peru, the terminus of the Illinois canal, by way of the Illinois River, which is very deep and broad nearly its whole length. This new outlet is called for partly by the conviction that the Southern rebellion has destroyed the commerce of the lower Mississippi and New Orleans beyond a hope of redemption, and partly to prevent a monopoly of freight which the Western road seems to impose.—*Commercial Bulletin.*

AFRICAN MOUNTAINS.—M. Malte-Brun has published a letter in the *Débats*, announcing a geographical fact communicated to him by the traveller, Dr. Barth, of Berlin. It may be remembered that the German missionary Rehmann, when travelling in the mountainous country of Jagga (eastern coast of Africa), in 1848, thought he saw in the distant horizon the tops of two mountains covered with snow. The permanent presence of snow in that latitude was thought improbable, and the general conclusion in Europe was that the missionary had been deceived by some optical illusion. The fact is now fully established, however, by a letter which Dr. Barth has received from Baron de Becken, who, in company with Mr. Thornton, a geologist, has, after surmounting immense difficulties, succeeded in reaching Kilimandjaro, one of the two mountains seen by the missionary, and intends going to the other, called Kenia, in February next. Kilmandjaro is of volcanic origin, and its height, according to the baron's measurement, is above 20,000 English feet (6,500 metres), and the upper 8,000 are covered with snow. Dr. Barth expects shortly from Baron de Becken a complete account of his discoveries.

On Monday evening last during a discussion on "A system of drainage from under drainage," at the Institution of Civil Engineers, Mr. Bailey Denton read a letter from Lord Palmerston. The letter consisted of six sides of letter paper. It was written by the venerable Premier at a time when he was suffering from an attack of gout, and when he was every hour expecting news from America, on the Trent embroglio. Every sentence of the letter was pertinent and to the purpose, much more so than many of the speeches delivered on the question. Lord Palmerston could scarcely have written a more sensible and useful letter, had he devoted his life to agricultural engineering.

A magnificent new screw steamer, the Scotia, has been just put on the station of London and Dundee. She is the property of the London shipping company, was built by the Messrs. Gourlay & Co., of Dundee, and made her first trip to London last week. The internal fittings of the Scotia are of the most beautiful description, and altogether she is one of the handsomest screw steam ships afloat. Probably we may be in a position to furnish after her next voyage to London dimensions and further particulars of this specimen of the handiwork of our Scottish friends.

GIGANTIC IRON CASTING.—In noting, says the *Liverpool Albion*, the iron work capabilities of Liverpool, we have on several occasions been led to refer to the ease and success with which the most Titanic kinds of ironwork can be accomplished in the leading establishments of the town, and it affords us pleasure to mark and chronicle from time to time the practical illustration of such skill and power. A notable and gratifying instance of this was afforded to us on Friday afternoon, at the well-appointed and extensive foundry and engineering works of Messrs. Fawcett, Preston, and Co. This was the casting of a huge fabric of iron, intended as the sole or anvil-block of a gigantic steam hammer, about to be erected on the premises of the Mersey Steel and Iron Works. Some idea of the magnitude of this casting may be formed from the statement that it was a somewhat irregular mass of metal measuring nine feet square on the base, which is twelve inches thick. From the middle of this base there rises a vertical projection five feet high, seven feet wide from side to side, and twenty inches thick. This, which forms the bed of a steel anvil, is supported by four diagonally-shaped ribs, tapering from the base to the top of the vertical ridge; these ribs being each twelve inches thick. Midway between the ribs there are two blocks, one on each side of the vertical ridge, and connected with it, each measuring two feet high by two feet six inches wide. The whole of this irregular series of concentric cubes form, it must be remembered, one homogeneous mass of metal of the enormous weight of between thirty-five and thirty-eight tons. To complete this stupendous casting, no less than forty tons of metal were melted; yet such are the comprehensive and efficient means of operation possessed by Messrs. Fawcett, Preston, and Co., that the whole of this immense weight of metal was fused and run without any addition to their ordinary appliances or staff of operatives. The casting, which was in every respect most successful, was witnessed by a large assemblage of ladies and gentlemen, the scene being at once impressive and interesting. In a semicircle were arranged a large number of curiously anxious spectators, while the central space was occupied by huge cranes, worked with energetic activity by stalwart men, whose swart brows formed a striking contrast to the inquiring and half alarmed visages of the onlookers, as they gleamed in the fiery radiance of the cataracts of molten iron which spouted from the seemingly volcanic mouths of two vast air furnaces, or received a conflicting glare from huge tubs of liquid metal gathered from the outlets to two blast cupola furnaces, as their contents were added in supplementary libations to the raging streams of glowing metal weltering through the portals which lead to the deeply buried mould. Variety was given to this impressive scene by rapid and numerous corruscations of stellar particles shot off from the fiery mass, and forming a pyrotechnic display of unusual brilliancy. The whole of the perilous-looking process of casting was completed in less than a quarter of an hour from the opening of the furnaces, and happily without the slightest accident.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c., 1643.
BOILERS AND THEIR FURNACES, &c., 1641, 1673, 1679.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1635, 1657, 1660, 1663, 1664, 1678, 1683, 1685.
SHIPS AND BOATS, including their fittings, 1691.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1667, 1688, 1690.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1642, 1659, 1662, 1666, 1705.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1637, 1668, 1677, 1680, 1684, 1687.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 1644, 1651, 1653, 1686.
LIGHTING, HEATING, AND VENTILATING, 1614, 1651, 1653, 1686.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1639, 1649, 1656, 1658, 1660, 1672, 1675, 1676, 1681, 1682, 1696, 1689.
METALS, including apparatus for their manufacture, 1695.
CHEMISTRY AND PHOTOGRAPHY, *None.*
ELECTRICAL APPARATUS, *None.*
WARFARE, *None.*
LETTER-PRESS PRINTING, &c., 1632.
MISCELLANEOUS, 1631, 1647, 1655, 1665, 1674, 1689, 1692,

1634. J. R. and F. C. TUSSAUD. *Improvements in obtaining the separation of feathers, hair, or other covering from the skins of animals, and in securing such in position when separated.* Dated June 26, 1861.

For the purposes of this invention, the patentees introduce in a liquid form on the outside of the skin, a solution of some matter, adapted when the solvent thereof has evaporated, or the matter employed has solidified, to form an artificial skin close upon the natural one, by which to hold the feathers or hair or other covering thereof at or near the roots, and in their desired relative position, in order to the skin being removed without its necessarily being destroyed. They first lay the skin inside downwards upon a board or other suitable surface, and apply thereon the solution of matter, which, after the evaporation of the solvent, or the solidification of such matter, will, by acting as a temporary artificial skin, serve to hold the feathers, hair, or other covering in position during the removal of the natural skin, taking care that such matter be introduced amongst the feathers, hair, or other covering of the skin as near as possible to their roots. A solution of shellac in alcohol answers well for the production of the artificial skin. When the shellac has become dry by the evaporation of the solvent, the skin may be drawn off the inner ends of the feathers, hair, or other covering, leaving such held by the shellac. They then cleanse the projecting roots of any remaining fatty or animal matter, and apply upon such inner ends a coating or solution of india-rubber or other suitable adhesive matter. To facilitate the removal of the natural skin from the roots they prefer to steep it for a time in lime water, as is practised by tanners. *Patent completed.*

1635. H. A. FLETCHER. *Improvements in railway-wheels and tyres.* Dated June 26, 1861.

Under one modification of this invention the tyre, of the wheel is rolled or made with a feather or central projecting rib, formed on the back or inner surface of the tyre. The sides of this feather are turned or otherwise shaped to form a dovetail or wedge-shaped rib, the narrower portion of the rib being next the inner face of the tyre. The wheel is formed in two halves, which meet together at the central part, forming the boss of the wheel; the spokes are duplex, and extend outwards a little from the boss in a diverging or angular direction. Each of these duplex or double series of spokes is connected at the outer extremities by a rim; there are thus two rims arranged parallel and with their inner faces converging towards the peripheries. The dove-tail feather of the tyre is inserted between the converging faces of the rims, so that, when shrunk on, the tyre is tightly wedged between the rims. The tyre is further secured by a bolt passed through the head of each spoke, and secured on the other side by a nut. *Patent abandoned.*

1636. H. COULTER. *Improvements in lamps, specially intended to burn oils and other inflammable fluids, rich in carbon.* Dated June 26, 1861.

This invention consists in directing to the upper part of the flame a large supply of oxygen of the air, which the inventor proposes to effect by enclosing the wick and lower part of the frame in a cap, the sides whereof are pierced with small holes, for the passage of atmospheric air. One side of the aforesaid cap impinges against the flame, and at the opposite side space is left between the wick-holder or tube, and the cap for the purpose of creating a draught. The wick-holder consists of a sliding tube, connected to the top of the cap, and fitted with a spring for raising and lowering the same. The above-mentioned cap may be formed with one or more sides, and instead of being entirely open at top may be partially closed. *Patent abandoned.*

1637. J. HIGGINS and T. S. WHITWORTH. *Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.* Dated June 26, 1861.

This refers, 1, to those machines in which a revolving ring-flyer is used, bearing by its periphery against supporting rollers, and through which ring-flyer the cop or bobbin of material passes, and consists in supporting such ring-flyer by extending it downwards, and there adapting a bearing, and for this bearing the patentees use a tube attached to the copping rail, which tube also supports the spindle by which the bobbin is carried, or upon which the cop is formed. Or, instead of the tube above referred to, they form a bearing for the ring-flyer by a stationary rail, through which the said tube passes. Or they place a similar bearing above the ring, instead of beneath it, as above-mentioned. *Patent completed.*

1638. S. A. BELL. *Improved machinery or apparatus for arranging and securing splints, tapers, or matches in frames, preparatory to dipping.* Dated June 26, 1861.

Here the splints or wax tapers are placed in a box, in which box openings are made in one end, from and through which the splints and matches are pushed end-wise into the grooves or holes made in the dipping frames to receive them. The splints or matches are pushed out of the box by a series of wires or pistons, the ends of which are inserted at the opposite end of the box, and will abut against the ends of some of the splints. A cutting apparatus may be combined with this pushing apparatus. *Patent abandoned.*

1639. A. LION. *Certain improvements in the fastening of bracelets.* Dated June 26, 1861.

Here the patentee uses a screw, which he fits on either of the two portions forming the fastening, that is to say, either on the spring bolt, or male portion of the fastening, or else on the opposite portion of the fastening, that is to say, the mouth-piece, socket, recess, or female portion that receives and retains the spring. By easing the screw in combination with the fastening, the portions of the latter are held firmly together, and the bracelet can be effectually and securely fastened. *Patent completed.*

1640. J. COWAN. *Improvements in apparatus for reburning animal charcoal.* Dated June 26, 1861.

This consists in so constructing and arranging the cylinder or retort in which the animal charcoal is reburned, that when it is removed from the cylinder or retort, it is preserved from the action of atmospheric air. *Patent completed.*

1641. D. F. GRIMALDI. *Improvements in rotatory steam boilers.* Dated June 27, 1861.

This relates to a previous patent granted to the present inventor on the 9th August, 1860, No. 1,927, and consists, 1, of tubes to be added to the rotary boiler, described in the above-named patent, so as to greatly extend its heating surface. 2. Of making hollow both the trunnions by which the boiler is supported on the bearings, so that the feeding-pipe finds its way into the boiler through one of the trunnions, and the steam pipe and the two pipes of the water-gauge through the other. 3. Of bending up the steam pipe within the boiler, so as to take the steam near the top of the same. 4. Of substituting partially or totally a double casing to the brick-work, or enclosing one or more rotatory steam boilers, within an ordinary boiler. 5. Of fitting the safety valves and steam gauge directly on the steam pipe, near the boiler, when a steam chest is not made use of. 6. Of making the trunnions revolving not directly through the bearings, but revolving in pinions fitting in the inner surface of the bearings in the case, the trunnions being of a large diameter; in this way the friction is greatly diminished. *Patent abandoned.*

1642 M. A. F. MENNONS. *Improvements in cocks or taps for drawing off liquids, and in gauging apparatus connected therewith.* (A communication.) Dated June 27, 1861.

This consists, 1, in the application to taps or cocks of a cast shoulder piece, forming a hammer face, and situated behind the key, in such a position as to be easily struck when the tap is being sunk in a barrel or other vessel. 2. In the application of such taps or cocks of a lever key set horizontally, with its free extremity towards the barrel, so as to be beyond the reach of accidental contact. 3. In a moveable gauging apparatus applicable to stop cocks constructed as above, and serving as indicator of the contents of the vessel to which it is applied. *Patent abandoned.*

1643. W. MCNAUGHT. *An improved method of supporting diagonal, condensing, and other steam-engines.* Dated June 27, 1861.

This consists in such an arrangement of framing that the patentee is enabled to dispense with all the usual stone foundations, the stability of the engines depending upon the "side walls" of the engine house. He attaches by bolts or otherwise, the framing of the engine to the side walls, and also provides transverse beams extending from each side wall to assist in supporting or carrying the engine. *Patent completed.*

1644. H. COULTER. *Improvements in door-springs.* (A communication.) Dated June 27, 1861.

This consists in a method of constructing a door spring, whereby a more uniform resistance is obtained, and whereby the door may be retained either partially or entirely open, as required. *Patent abandoned.*

1645. H. HAMER. *Improvements in chimney tops and ventilators.* Dated June 27, 1861.

This consists in arranging and constructing apparatus with flanges and openings or apertures, so that downward currents of wind will be reversed or diverted when coming in contact therewith, and caused to ascend, instead of descending the chimney or ventilating shaft, thus tending to increase the draught. *Patent completed.*

1646. J. C. SMART and A. AITCHISON. *Improvements in the manufacture of charcoal.* Dated June 27, 1861.

Here the patentees place within suitable retorts of metal or earthenware, bark knots, or the refuse bark of tan pits, or produce of other trees, and burn them while in the retorts until they are reduced to ashes, which are to be quickly withdrawn into an air-tight box or receiver. The ashes are then to be left to cool in the box, whereby the charcoal will be produced, which may then be powdered, if required for foundry work, or left in lumps if for ordinary use. *Patent completed.*

1647. J. DOUGHTY. *An improved apparatus for obtaining and applying motive power.* Dated June 27, 1861.

Here the inventor proposes using a bed-plate, having standards erected thereon, to carry a driving shaft, upon which is secured the motive-power wheel. This wheel is divided into sections by channels or grooves, in which are metal slides actuated by toothed wheels and screws. And it is provided with two semi-circles near its centre, one having teeth around its periphery, the other having teeth within, so that when each slide leaves its vertical position, it commences to project from the edge of the wheel, when, by its own weight, it falls into a horizontal position, and a weight of the next slide carrying it past, it then co[illegible] ences to return by the means before stated [illegible] ain takes a vertical position, by which time it returned to its place within the periphery of the wheel, neither end projecting, and so on with each succeeding slide, thus imparting a continuous motion to the shaft. *Patent abandoned.*

1649. J. Gibson. *Certain improvements in, or applicable to, sewing-machines.* Dated June 28, 1861.

This consists in applying to sewing-machines a vessel containing water or other liquid, either alone or combined with size or bees-wax in a fluid state, through which the sewing thread is conveyed in its passage from the bobbin to the needle, the object being to render the work firmer and more durable, and to prevent the breaking of the sewing thread; the needles will also last much longer than when dry thread is used. *Patent abandoned.*

1650. T. Swinnerton. *A new or improved manufacture of coal-gas, by the surplus or waste heat of the blast ovens and puddling-furnaces used in the manufacture of iron.* Dated June 28, 1861.

The patentee claims disposing or arranging (essentially in the manner described and illustrated) gas retorts, in the said blast ovens and puddling furnaces, so that the surplus or waste heat of the said ovens and furnaces may heat the said retorts, and generate gas from the coal charged into the said retorts. *Patent completed.*

1651. A. Ford. *Improvements in the manufacture of waterproof felt.* Dated June 28, 1861.

This invention consists essentially in mixing hair or wool, hempen or cotton fibre, with india-rubber or gutta-percha, so as to produce a light pulpy dough, capable of being rolled out with the aid of water, into sheets of a felt-like appearance. *Patent abandoned.*

1652. J. W. Harland. *An improvement or improvements in the manufacture of wood and other types, or substitutes therefor, and also in the matrix or apparatus for producing the same.* Dated June 28, 1861.

This relates to the material of which the types are to be formed. The inventor takes paper, or the pulp of which paper is made, horn raspings, or shavings, bone dust, wood shavings, or saw dust, of the same or other substances in a state of comminution. A quantity of one or more of the above substances being provided, he saturates it with size or fish glue, or other cement. The material thus prepared is next pressed into a matrix of a form, to give it the shape of the type required. Mechanical pressure is next applied, which must be sufficiently great to make the material take accurately the shape of the matrix. This operation being performed, the type is removed from the matrix, and after being dried, is, if necessary, reduced to the correct size for being used in the printing press. It also has reference to the matrixes or dies in which the composition or material is to be moulded into the form of the type required. *Patent abandoned.*

1653. J. W. Graham. *Certain improvements in machinery or apparatus for cutting, shaping, and dressing stone, or other similar substances.* Dated June 28, 1861.

Here the stone is placed upon a bed or table to which a reciprocating sliding motion is imparted. Above this table a beam extends from end to end of the machine, upon which an adjustable framing is supported, carrying an arrangement of bevil gearing in connection with toothed wheels, which are attached by cranks to a tool box containing the chisel or chisels, and at the required angle for cutting; and the upper portion of this tool box is furnished with a weight by which the chisel is caused to cut or chip the stone. When motion is imparted to the gearing, the cranks will cause the chisel in the tool-box to make a succession of strokes upon the stone, which, by the effects of the weight or hammer, will cause the stone to be cut or chipped to any form or size, which together with the depth of the cut may be regulated or controlled by the attendant. In order that the edge of the chisel may not become unequally worn, it is turned half round at each stroke by a crank or other means, so that each side is presented alternately to the stone. *Patent completed.*

1654. H. J. Rouse. *An improvement in hand-lamps.* Dated June 28, 1861.

This invention refers to those hand lamps in which coloured glasses are placed, capable of being revolved to shew a different colour for signalling purposes. The invention consists in carrying a ring, a stud, or other appliance connected to the frame in which the coloured glasses are fitted through the bottom of the lamp frame; in order that the turning of the glasses may be effected from the bottom of the lamp frame, a shield in the form of a deep ring protects the appliance for turning the glasses, and at the same time forms a stand for the lamp to rest upon when not carried.

1655. D. B. White, M.D. *Improvements in the mechanical compression of various substances, and in apparatus employed therein.* Dated June 28, 1861.

This invention consists, first, in compressing substances in a vessel or chamber the capacity of which can be diminished, or the sides or ends of which can be brought closer together by the action of water, steam, or other fluid, communication being retained, if required, between such vessel or chamber and the open air, or an exhauster, by which the enclosed air may be either partially or entirely expelled or withdrawn. The invention, consists, secondly, in a method by which the substance compressed may be so retained until it is bound. For this purpose, at the extremity of the cylinder in which the material is to be compressed, the inventor places the upper part of a cross-barred box or holder, the lower part being laid on the top of the piston or plunger. When the piston has risen to the proper position, the lower part of the holder is locked into the upper, and the material retained in a compressed state until it is removed from the cylinder and bound, in certain cases he envelops the material in an air-tight covering or sack or bag.

1656. S. Middleton and J. Wright. *Improvements in apparatus for the manufacture of boots and shoes.* Dated June 28, 1861.

This consists essentially in the use of a metal box of the shape of the boot, into which box the boot, when on the last is placed, and by suitable mechanical appliances the inner sole is attached to the upper leather, and the outer to the inner sole. *Patent abandoned.*

1657. M. Lane. *Improvements in the permanent way of railways.* Dated June 28, 1861.

Here certain longitudinal bearers of wrought-iron are used; they may be of any desired length, and placed at intervals along the line, but they may be continuous. The rails used with these bearers are rolled with an under web or projecting rib, which is of a dovetailed section. By this invention the rails are prevented from rising, being held in their position by the aforesaid longitudinal bearers. *Patent completed.*

1658. C. Glassborow. *Improvements in pianofortes.* Dated June 28, 1861.

This relates to various improvements upon the action of pianofortes, and applies more particularly to upright pianofortes, and comprises much detail, which we cannot here give space to. *Patent abandoned.*

1659. J. B. Hawkins. *Improvements in the construction of cocks for drawing off liquids and vapours, and for regulating the flow or passage thereof.* Dated June 28, 1861.

This consists in so constructing such cocks as to prevent fixing or setting of the plugs thereof in their seats. *Patent abandoned.*

1660. R. N. Eagle. *Improvements in riding stirrups.* Dated June 29, 1861.

Here the stirrup is suspended, so as to incline the head or bottom of the same inwards and upwards towards the body of the horse when pressed upon by the foot of the rider. For this purpose, the point of suspension of the stirrup is made inside a line perpendicular to the centre of the head thereof, and this point of suspension is adjustable as required by an adjusting screw, or other mode of fixing the loop to the strap on the pin or axis for connecting the lower part of the loop with the upper part of the stirrup. The stirrup is also suspended from an eye, forming such an angle with the body of the stirrup as will obviate the tendency to twist the strap, and give a ready entrance to the foot when the toe is directed towards the shoulder of the horse. The stirrup is also suspended from a horizontal axis, in a line parallel with a line which would cross the foot diagonally from the little toe to the instep. *Patent abandoned.*

1661. J. Dyer. *Improvements in the ornamentation of certain cabinet furniture.* Dated June 29, 1861.

This has reference to deal or pine furniture, whereby an effect similar in appearance to a superior class of polished ornamental wood may be produced, and consists in producing upon the surface or surfaces of the same stained patterns or devices, in imitation of the ordinary marquetry, inlaid, moulded, or banded work in colored fancy woods. *Patent completed.*

1662. A. Wood. *Improvements in the construction of fermenting tuns and apparatus for storing beer.* Dated June 29, 1861.

We cannot here devote space to the voluminous details of this invention. *Patent abandoned.*

1663. W. Leopard. *Improvements in railway brake apparatus.* Dated June 29, 1861.

This relates to railway brakes for stopping and retarding carriages, in which the momentum of the train is caused to take effect on the brakes. The inventor effects this by toothed or friction surfaces, formed or fixed on the axles of the carriages; these toothed or friction surfaces are caused to operate on longitudinal bars placed above and below the axles, which slide at each end in suitable bearings fixed to the framework, such bars having rack teeth or friction surfaces corresponding with the axles, so that, when pressed on the axles they are propelled lengthwise one in the opposite direction to the other. *Patent abandoned.*

1664. W. Clark. *A new locomotive apparatus, having a movement resembling walking.* (A communication.) Dated June 29, 1861.

This is intended to apply chiefly to dolls and other toys. It consists of a frame or box supported upon legs and feet, which, by the action of a spring or other motive agent within the said frame or box, are caused to have an alternating step by step movement. Also in certain means by which the motor within the box is made to actuate the legs. Also in a certain construction of such legs and feet, each by being formed of parallel bars, with the feet so applied that the foot may be placed flat on the floor, or other surface on which the walking is performed, at every step, and so ensure steadiness of movement. Also in an arrangement of the feet, whereby the apparatus is balanced; and further in a construction of the legs, whereby the movement of the knee joint is imitated. *Patent abandoned.*

1665. W. Clark. *Improvements in excavating machinery.* (A communication.) Dated June 29, 1861.

This consists in a mode of applying and operating a rotary spade wheel, whereby it is made capable of working with its axis below the surface of the ground, while driven by machinery above the surface. Also in means of carrying and clearing away the dirt from the spade after they have raised it above the surface of the ground. Also in a construction of the framing of the machine to provide for the raising and lowering of the spade wheel. Also in means of gauging the line of descent of the bottom of the trench or ditch dug by the machine; and, further, in means of preventing the falling back into the tender or ditch of the dirt which may fall from the spades after having been raised above the surface of the ground. *Patent completed.*

1666. W. Clark. *Improvements in the destructive distillation of solid and liquid matters.* (A communication.) Dated June 29, 1861.

This consists in injecting in the middle of the combustible materials hot incombustible gases, so that the heating and destructive distillation may be, so to speak, interior and molecular, and have an active effect on the gaseous or liquid products which are evolved. The patentee uses this method of distillation for all combustible materials, either solid or liquid, or a mixture of the two. Under the name of incombustible gas is implied azote, carbonic acid, hydrogens, &c., used either separately or together, and previously heated. He can use especially the fumes resulting from complete carbonization. He applies, for example, this new method of distillation to peat placed in furnaces similar to those used in making gas. To obtain greater results and more perfect distillation, he reheats the volatile products generated, in a new and special retort, in which all the carbonate of hydrogen liquids, or tar, are converted into gas. *Patent completed.*

1667. I. Bragg. *An improvement in the construction of reaping and mowing machines.* Dated June 29, 1861.

Here the patentee makes each finger or guard in two parts, which he attaches respectively to the upper and under side of the finger bar. For the purpose of keeping the spaces between the fingers clear, he places the knives alternately on opposite sides of the knife or cutter bar. The space thus left allows the knives to keep the fingers clear. *Patent completed.*

1668. A. V. Newton. *Improvements in lapping used in machines for printing textile fabrics, part of which improvements is applicable to driving bands.* (A communication.) Dated June 29, 1861.

The patentee claims, 1, the use in printing machines of a lapping made in the form of an endless band or belt, and composed of one or more layers or thicknesses of woven material, either with or without a surface or coating of india rubber or gutta percha, as described. 2. Uniting the ends of woven driving bands, whereby an even lap or junction will be produced, in the way described. *Patent completed.*

1669. W. Livesey. *Improvements in wet gas-meters.* Dated June 29, 1861.

The object here is to connect the meter direct to the iron service pipes, without the use of lead or other flexible pipes or soldered joints; to regulate the opening and closing of the inlet and outlet pipes simultaneously; to ascertain the level of the water inside the meter without putting the meter out of action; to prevent the oscillation of the lights from any sudden increase or irregularity in the pressure; to prevent any injurious effect upon the registration, from the meter being tilted or placed out of its level, and to simplify the index. The invention is not described apart from the drawings. *Patent completed*

1670. W. Dingwall. *Improvements in fluid meters.* Dated June 29, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1671. J. H. Johnson. *Improvements in apparatus for manufacturing and bottling aerated liquids.* (A communication.) Dated July 1, 1861.

This invention consists in a method of combining three distinct apparatuses, whereby they are caused to work simultaneously, and in concert with each other. *Patent completed.*

1672. F. Potts and R. Cox. *An improved mode of treating tubes used for posts for metallic bedsteads, and other purposes, and in the machine for producing the same; which said machine is also applicable for cutting out and piercing articles of sheet metal, such as washers, metallic bucket-ears, and other such-like articles.* Dated July 1, 1861.

Here the treatment of tubes for supports or posts of metallic bedsteads relate to such only as are to be connected with cast iron or other metal joints. The object of the present invention is to prevent the molten metal (when forming the dovetail or other joint for uniting such posts to the side or end rails or other parts forming the bedstead) running through and filling or partially filling up the interior of the tubes, and this is effected by inserting in the ends of the tubes, in connection with the intended cast joint, iron or other metal discs of the same diameter as the internal diameter of the tubular foot or post desired to be stopped. *Patent completed.*

1673. J. Shepherd and W. Goodfellows. *Improvements in apparatus for carrying off the scum in the water in steam-boilers.* Dated July 1, 1861.

For this purpose the inventors use one or more floating receivers, rendered buoyant by air-tight chambers, or other means, the said floating receivers being connected to the waste-pipe by tubes within each other, similar to a telescope, or by pointing one tube, so that it can vibrate upon another tube, in order that the receivers can rise or fall with the surface of the water as it varies in height or depth, and thereby carry off the scum to the waste-pipe, which is opened as required. *Patent abandoned.*

1674. L. H. Spence. *Improvements in means or apparatus for the manufacture of paper bags or envelopes.* (A communication.) Dated July 1, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1675. W. Barber. *Improvements in the manufacture of hats.* Dated July 2, 1861.

Here the inventor "curls" shapes or "tips off" hats, of whatever materials made, by a mould of the intended brim, and he forces the brim of the hat into contact with this mould by an elastic bag, into which he forces water, air, or other fluid. *Patent abandoned.*

1676. S. Heilbronner Gerstle. *Improvements in the manufacture of needle or tapestry work and coloured embroiderings.* Dated July 2, 1861.

Here the design or outline of the desired pattern is printed on the canvas forming the ground or back, and a copy of the design is printed on paper or parchment, and the various colors indicated thereon by numbers or letters, each color being indicated all over the design by its own mark. Along one of the sides of the canvas is fixed a strip of paper, with the same series of numbers or letters as are inscribed on the design paper, and close to each number is fixed a small sample or tuft of yarn of the color to which this number or other mark refers. By this means the operator will only be required to look at the number inscribed in that part of the design-paper which is to be imitated, and will thus find at once the color of yarn to be made use of for that part, which yarn is then stitched or worked on the canvas or back in the ordinary manner. *Patent completed.*

1677. J. P. E. Paignon, J. M. Vaudaux, and G. Gagnière. *Improvements in jacquard looms, with the object* *of allowing the substitution of endless paper in lieu of the pasteboard pattern cards hitherto used therein, and in machines for perforating the said paper.* Dated July 2, 1861.

The patentees claim, 1, the general arrangement and mode of working of the improved jacquard machine, allowing the use of perforated endless paper in lieu of the ordinary pasteboard pattern cards hitherto made use of in such machines, the said arrangment being combined, so that the pressure of the paper against the horizontal needles takes place only when their hooks, wires, or vertical skewers are resting with their lower ends on the harness board, and thus being in proper equilibrium, allow the said needles to yield with the utmost facility to the pressure exerted on them by the paper. 2. Producing the endless paper to be made use of in the improved jacquard apparatus with proper division folds, for causing the paper suitably to apply itself against the flat sides or surfaces of the cylinder or perforated square axis. *Patent completed.*

1678. J. Potts. *Improvements in machinery for sounding fog and other bells.* Dated July 2, 1861.

This consists in producing a more full and clear sound from the bell when struck, without any variation in intensity, than can be obtained by any other plan hitherto used. For this purpose an upright standard, having in suitable bearings a spindle, carries thereupon a weighted lever, to which is attached a segment of a tooth which gears in with a pinion, to which pinion motion is imparted by a clock machine. To the weight is connected, by a lever, a shaft working horizontally in two standard brackets. The shaft comes in contact with the clapper of the bell to be sounded. *Patent abandoned.*

1679. J. G. Wilson. *Improvements in the means or apparatus employed for feeding steam boilers with hot water.* Dated July 2, 1861.

This consists in the application of a valve to the said tubes or feeding apparatus, so arranged and connected with the boiler that, when the pump ceases to force the water through the tubes, the valve will open to the water in the boiler, and allow it to circulate in the tubes, and thus prevent explosion or damage to the tube. *Patent completed.*

1680. A. Hill. *Improvements in spinning and doubling machinery.* Dated July 2, 1861.

For the purposes of this invention the bobbin remains stationary or fast on the upper end of the spindle, and the lower part of the bobbin is drilled or cut out so as to leave a space all around between it and the spindle, in order that a tube connected with the flyer may move up and down and turn freely within the lower end of the bobbin. The two limbs of the flyer are fixed in a cylindrical tube, the lower end of which, where the limbs are affixed thereto, is of larger diameter than the upper part of the cylindrical tube which rises into the lower end of the bobbin. The interior of the cylinder which carries the limbs of the flyer is of larger diameter than the spindle, excepting at the upper end of such cylinder, where it touches the spindle. The rail by which the flyer is raised and lowered is actuated as heretofore, and where each spindle passes through it, there is a bearing for the lower end of the cylinder of the flyer, and such bearing is made slightly concave on its upper surface, where the end of the tube or cylinder of the flyer rests. In the centre of such bearing there is a fixed tube, within which the spindle revolves; this fixed tube enters the lower end of the cylinder of the flyer, and the same is capable of turning on such fixed tube. In some cases the interior diameter of the lower end of the cylinder which carries the limbs of the flyers is not of larger diameter than the spindle, in which case there is no fixed tube to the bearing or part which supports the end of the cylinder to which the limbs of the flyer are affixed. *Patent abandoned.*

1681. H. H. Bishop. *Improvements in sewing machines.* Dated July 2, 1861.

This invention consists in a peculiar combination of mechanical parts for giving motion to the needle. For these purposes, in order to give the requisite up and down motion to the bar in the end of which the needle is fixed, such bar at its upper end is pin jointed to a slide, which is guided correctly in its motion by moving between fixed guiding surfaces. To the upper end of the slide, one end of a connecting rod is attached by a pin-joint, the other end of such connecting rod being attached to a crank or arm, formed or fixed on one end of a rocking shaft, which has its bearings carried by the fixed arm of the sewing machine. At the other end of the rocking-shaft, is another crank or arm, which, by a connecting rod, is connected to a crank on the driving shaft of the machine. In order to cause the work to move a distance between the succeeding stitches, there is another rocking shaft used, which turns in suitable bearings, also carried by the fixed arm of the sewing machine. At one end of this rocking shaft an arm is fixed, the end of which is in contact with, or otherwise actuated by, a suitable cam, in such manner as to cause the shaft to rock slightly at the time the needle is in the fabric or fabrics, in order that, by another arm fixed at the other end of the rocking shaft, it may cause the needle bar and the needle to assume an inclined position in regard to the slide, to which, as before mentioned, it is connected by a pin joint. By these means the work is moved a distance each time the needle descends into it, so that, when the needle has been withdrawn by the movement of the slide, actuated by its rocking shaft, and the needle has been caused by the rocking shaft and cam again to assume a vertical position, the needle will, when it next descends into the work, pass through it at a distance from the point where it previously passed into the work. *Patent completed.*

1682. M. Henry. *Improvements in or applicable to pianofortes and other musical instruments.* Dated July 2, 1861.

The object here is to provide performers on pianos and other musical instruments, with means for "transposing" pieces of music. *Patent abandoned*

1683. S. Adams. *Improvements in omnibuses for street railways, part of which is applicable to other carriages.* Dated July 2, 1861.

These improvements consist in a contrivance for locking and disengaging the pole of omnibuses for street railways, which greatly increases the safety and speed, by facilitating the running on and off the metals, as occasion may require. This is accomplished by a double or two ended lever, which is acted upon by the drivers feet, so that, when the vehicle is off the rails or metals, the pole is fixed and the lock in action, and when on the rails, the pole is loose and the lock fixed. The fixing of the pole to the lock is by a pin or bar of iron or steel, having a fork at the lower end; the other end is a bolt; the fork end fits on and partly clips the pole when down, and thus fixes it to the lock; the forked pin is moved up and down by being connected indirectly to the foot lever; when the forked bolt is up, the bolt slides into a socket fixed to the landing. Next, the inventor has a brake apparatus which can be worked by either driver or conductor, or both. It consists of levers, two to each hind wheel, one on each side; the levers are acted upon by rods and chains, and the long end of each pair of levers are connected together by chains, which have the form of a rhombus or diamond, two opposite corners are connected to two of the levers, and the other corners are connected to the rods, and so on to the rotating brake handles: the blocks or rubbers are prevented, when not in use, pressing the wheel by a coiled spring. *Patent abandoned.*

1684. H. B. Barlow. *Certain improvements in machinery for spinning.* (A communication.) Dated July 3, 1861.

This consists, 1, in certain improved combinations of machinery for imparting a variable speed to the carriage of the spinning machine, which can be modified according to the quality of the fibres to be spun. 2. In performing the two operations of roving, or coarse spinning and fine spinning, in the same machine. 3. In the application of self-acting mechanism to machinery for spinning carded wool or other animal fibres, by which the running in of the carriage, the backing of, the winding on, and the other motions required to render the machine self-acting, are effected. 4. The application of differential motion to the spindles while the twist is being given to the yarns. *Patent completed.*

1685. R. Richardson. *An improved railway chair for railways.* Dated July 3, 1861.

This consists in an improved chair, by which the upper lips of iron half chairs are, by elongation, made to wedge through or into each other on opposite sides of the rails, and in opposite directions, so as to firmly secure the rails in the chairs, without the aid of the wooden keys. The invention also applies equally to single and double-headed rails, and also to the construction and application of half chairs, so as to retain the wooden or iron keys in their places on each side of the rail, and thus obviate the necessity of the half chairs wedging, as before-named, and by simply placing them in contact with the ends of the wooden or iron wedges or keys before referred to, to prevent the keys or wooden wedges from becoming loose and falling out. *Patent abandoned.*

1986. J. Terry. *An improvement or improvements in the manufacture of window sash pulleys, side pulleys, screw pulleys, and upright pulleys.* Dated July 3, 1861.

This consists in making the pulleys or rollers of window sash pulleys, screw pulleys, and upright pulleys, of glass, china, earthenware, or other vitreous or semi-vitreous material, instead of metal. *Patent completed.*

1687. J. Woolatt. *Improvements in looms.* Dated July 3, 1861.

This relates to improved modes of working several shuttles. Instead of the shuttles being placed in a drop-box, the inventor places them in a box at each end of the loom, apart from the slay or lathe, which boxes work in guides attached to the frame-work, and are moved as required by racks and pinions, the pinions being turned as required, according to the pattern by a jacquard motion. *Patent abandoned.*

1688. J. Simonton. *An improved traction engine and apparatus applicable for the cultivation of land.* Dated July 3, 1861.

The patentee claims, 1, an endless railway or platform, placed below the frame of the engine, which will support the weight of the engine, and at the same time in a peculiar way take hold of or grasp the surface of the soil firmly and tenaciously, so that the power of the engine may be applied to the traction of cultivating implements. 2. A mode of preventing priming in the boiler of such portable engine, by suspending the boiler from an oscillating centre above it, so that it shall by its own weight always hang horizontally, even when the engine is ascending or descending inclines. *Patent abandoned.*

1689. J. Bennie and W. Moffatt. *Improvements in the manufacture of heels, clog-irons, horse-shoes, chain-links, and similar articles, and in apparatus therefore.* Dated July 3, 1861.

This consists in making the articles entirely of steel, instead of steel combined with iron, or iron alone, as hitherto. Or the articles may, by the present invention, be made of iron and be case-hardened to render them more durable. The apparatus to be used in making the articles comprises mechanism for effecting several distinct operations. *Patent abandoned*

1690. G. Davies. *Improvements in apparatus for grinding corn and other matters.* (A communication.) Dated June 3, 1861.

This consists partly in using a nether stone or bed, embracing only a fourth part of the circumference of the moving stone, one of the extremities being about opposite to the horizontal radius of the circular stone, and the other extremity being about opposite to the lower vertical radius of the same. 2. In so mounting the bed stone that it can be rocked or oscillated on its points of support, to facilitate the dressing or setting of the same, and in forming any number of inclined transverse grooves therein (3 being preferred). 3. In the use of pedestals, for carrying the circular or revolving stone, capable of moving on slides fixed at an angle of about 45°, so that as the circular stone is set to or from the bed it moves on a line passing through the centre of the curve of the latter. 4. In the use of a small trough or spout to feed the grain to the mill, to which an alternate circular or rectilinear motion is given, in order to distribute the grain more evenly between the surfaces of the stones. *Patent completed.*

1691. C. Gilroy. *Improved means of resisting and extinguishing fire in buildings or on board ship.* Dated July 3, 1861.

This consists principally in fitting and constructing the rooms of buildings, and the cabins or other compartments of vessels, with water-tight or perforated ceilings, with pipes and union joints, to which the engine hose, or pipes from the main, or other water service may be connected, so that, in the event of fire in any room or compartment, the ceiling above the same may be charged with water, and thus not only will the water be discharged through the perforated pipes or perforated ceiling directly on to the fire to extinguish the same, but the ceiling being charged with water, will resist the fire, and prevent it from communicating with the stories or compartments above. *Patent abandoned.*

1692. R. Jolley. *An air tight inclosure for heating, cooling, or drying, infusing, extracting, or absorbing vapour and gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids, alimentary or otherwise* Dated July 3, 1861.

This apparatus or enclosure may be constructed of any shape or size, moveable for transit, or fixed, and upon any non-conducting principle, wholly or in part of pulp or fibrous substance, woven, compressed animal or vegetable matter, or made to cohere with any liquid or waterproof matter, resinous, vitreous, or otherwise, the same being fixed especially round all angles and joints to exclude air, water, heat, or cold. Within the top or any other part of the inclosure is fitted a vessel or vessels, metallic or otherwise, corrugated, ribbed, angulated, or not, with curve, elliptical, circular, angular, or flat sides, ends, or bottom, or all of such a form as will cause the adhesion of vapours during the process of extraction. These vessels are provided with pipes, traps, and drains for quickly carrying off what is extracted, and may be used with a continuous flow of hot or cold water, or air through pipes or not, or to be charged especially on the upper part with any liquid or solids mixed or otherwise, natural or artificial, producing heat or cold, according to temperature required; and these vessels may be double, or one within the other, and the space between may be exhausted or filled with any kind of liquid or solid, in like manner as the aforesaid vessel, or warmed by gas or any other means. Within the inclosure is placed in moveable cases, or otherwise, any absorbing liquid or solid which has an affinity for the particular gas or vapour which is required to be absorbed or extracted, and to prevent the counter attraction all metals used in the construction are covered by some fibrous material, also the enclosure may be used by exhausting therefrom the air by heat, steam, or pumping. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Oct. 3, 1861.

2473. W. Malam, Skinner-street, gas engineer. Improvements in apparatus for the manufacture of gas.

Dated Nov. 14. 1861.

2873. W. Leopard, Hurstpierpoint, Sussex, corn merchant. Improvements in railway break apparatus.

Dated Nov. 27, 1861.

2986. H. Brambach, 11 Lungengasse, Cologne, merchant. A new mode of manufacturing gas for illuminating purposes.

Dated Nov. 29, 1861.

3016. R. Cook and G. H. Spencer, Hathersage, Derby, manufacturers. Improvements in the manufacture of umbrellas and parasols.

Dated Nov. 30, 1861.

3019. J. Cooper, St. Margaret's Iron Works, Ipswich, and C. Garrood, Penge. Improvements in cultivators, horse hoes, and horse rakes.

Dated Dec. 5, 1861.

3055. M. Henry, 84 Fleet-street. Improvements in printing and ornamenting textile fabrics, paper hangings, and other materials, and in surfaces and apparatus for such purposes. (A communication.)

Dated Dec. 10, 1861.

3026. T. Higgins, Bow, Tornographer. Improved machinery for filling dipping clamps with tapers, match stems, and splints.

Dated Dec. 11, 1861.

3103. W. Clark, 53 Chancery-lane, engineer. Improvements in stoppering bottles and other vessels. (A communication.)

Dated Dec. 14, 1861.

3144. F. Kohn, 17 Southampton-terrace, Waterloo-bridge. An improved mode of copying writings, drawings, prints, and similar objects.

Dated Dec. 16, 1861.

3152. C. P. Vailas, 2 Kentish-town-road, zinc worker. Improvements upon or additions to certain description of portable baths, with the object of rendering them available for use as trunks or boxes.

Dated Dec. 17, 1861.

3160. J. W. Chalfont, 7 Denmark-grove, Islington, and D. Keys, 15 Craven-street, Strand, watchmakers. Improvements in the method of, and apparatus for, winding up fusee watches and pocket chronometers, and setting the hands without key.

Dated Dec. 19, 1861.

3184. J. H. G. Wells, 2 Sandhurst-villas, Binfield-road, Stockwell, C.E. Improvements in the method of, and apparatus for, pumping elastic fluids.

Dated Dec. 20, 1861.

3186. J. Smith, Stafford, and J. B. Higgs, Coven, engineers and machinists. Improvements in thrashing machines and in mills for grinding, and in apparatus for raising or moving grain in granaries and other places.

3202. G. T. Bousfield, Loughborough-park, Brixton. Improvements in machinery for attaching the soles of boots and shoes to the upper leathers. (A Communication.)

Dated Dec. 21, 1861.

3206. W. Bennetts, Tuckingmill, Camborne, Cornwall, engineer. Improvements in the mechanism required for and in the manufacture and composition of gunpowder.

3208. M. M. Williams, Handsworth, teacher. An improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydro-carbons therefrom, and in apparatus to be used for that purpose.

Dated Dec. 24, 1861.

3222. T. E. Vickers, Sheffield, steel manufacturer. Improvements in the wheels of railway engines and carriages, and in the machinery or apparatus to be used in making the same.

Dated Dec. 26, 1861.

3236. H. Dawes, Sale-green, Sale-moor, near Manchester, gentleman. Improvements in the method of treating steel for the manufacture of crinoline.

Dated Dec. 27, 1861.

3243. T. W. Atlee, druggists' factor, Birmingham. Certain improvements in cocks or taps for drawing off fluids.

3246. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in steam generators, and in fire-bars employed therein. (A communication.)

Dated Dec. 28, 1861.

3250. A. Warner, Threadneedle-street. Improvements in the manufacture of cases or receptacles for oil fuses and other articles used in the military and naval services.

Dated Dec. 31, 1861.

3260. W. Tongue, Chryssell-road, Brixton, engineer. Improvements in the manufacture of certain descriptions of woven looped and bobbin net fabrics, by the application of certain fibrous materials thereto.

3262. W. Tongue, Chryssell-road, Brixton, engineer. Improvements in the manufacture of umbrellas and parasols.

3265. T. Pickford, Fenchurch-street, merchant. Improvements in the manufacture of manure.

3268. J. Haslam, Preston. Improved apparatus for winding, holding, and letting go cords, bands, or chains, particularly applicable to window blinds.

3270. W. E. Newton, 66 Chancery-lane, C.E. Improved apparatus for obtaining motive power from explosive compounds. (A communication.)

Dated Jan. 1, 1862.

1. J. M. Rowan, Glasgow, engineer. Improvements in the manufacture of railway wheels, and in apparatus to be used therein.

3. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in hose pipe joints or couplings. (A communication.)

5. J. Walker, 25 City-road, engineer. Improvements in the construction of forts and fortifications, which are applicable to floating batteries.

6. T. C. Clarke, Liverpool, C.E. Improvements in the construction of apparatus for heating and circulating water and other liquids.

7. J. Bradbury, Pendleton, near Manchester, mechanic. Improvements in self-acting mules.

9. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in supporting and propelling vessels. (A communication.)

10. W. Bush, Tower-hill, C.E. Improvements in omnibuses and other carriages.

13. W. B. Patrick, Highgate, gentleman. Improvements in the manufacture of sugar, and in the apparatus employed therein.

14. E. F. Davis, Tavistock House, Tavistock-square. Improvements in gas burners.

16. W. E. Newton, 66 Chancery-lane, C.E. Improvements in coffee pots and boilers for culinary purposes, part of which improvements are also applicable for generating steam. (A communication.)

Dated Jan. 2, 1862.

18. W. E. Gedge, 11 Wellington-street, Strand. Improved apparatus for roasting coffee. (A communication.)

21. M. Cartwright, Carlisle, Cumberland, dentist. Improvements in the manufacture of models and of plates or pieces for artificial teeth.

23. H. Eschwege, 14 Mincing-lane. Improvements in treating wood and other vegetable spirit.

Dated Jan. 3, 1862.

24. E. Nugent, Brooklyn, New York. Improvements in fire-arms.

26. F. S. Belloche, and H. Boilack, 333 Rue St. Martin, Paris. An improved parasol.

Dated Jan. 4, 1862.

29. J. W. Arundell, 263 Gresham House, Old Broad-street, gentleman. An improved method and improved apparatus for removing impurities from coal, parts of which invention are applicable for the separation and cleansing of ore and other minerals. (A communication.)

31. C. Cross, Stratford, near Manchester, and E. Pedmore, Manchester. Improvements in the manufacture of piled fabrics and in machinery or apparatus employed therein.

33. G. Leyshon, Tividale, tinplate assorter, and D. Beckley, Brockmore, Stafford, grocer. An improvement or improvements in breaks for retarding and stopping carriages on railways.

37. A. Warner, 31 Threadneedle-street, merchant. Improvements in preparing materials for and in purifying coal gas.

Dated Jan. 6, 1862.

40. G. Betjemann, G. W. Betjemann, and J. Betjemann, Pentonville, desk and dressing case manufacturers. Improvements in dressing cases, applicable to other cases and boxes.

41. P. B. O'Neill, Hart-street, Bloomsbury. Improvements in screw wrenches or spanners.

43. F. Brown, ironfounder and ironmonger, Luton, Bedford. Improvements in kitchen ranges and cooking apparatus.

Dated Jan. 7, 1862.

45. J. Higgins, Salford, machine maker, and T. S. Whitworth, manager. Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.

48. A. Wallis and C. Haslam, Basingstoke, Southampton, engineers and ironfounders. Improvements in rotary screens.

Dated Jan. 8, 1862.

49. D. Beale, 10 Cobden-street, Saint Leonard's-road, Bromley, pattern maker. An improved method of fastening iron plates to ships' sides.

51. A. Heath, 12 Union-square, Islington. Improvements in the construction of inkstands.

53. C. Pilkington and T. Pilkington, Sheffield, joiners' tool manufacturers. Improvements in skates.

55. J. Stenhouse, 11 Upper Brunswick-terrace, Barnsbury-road, Middlesex, chemist. Improvements in rendering certain substances less pervious to air and liquids.

57. W. Bradshaw, Coventry, watchmaker. Improvements in watches.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2257. J. Smith. Sewing machines.
2269. W. W. Clay. Knitting machinery.
2272. W. Davis. Prevention of accidents.
2273. W. Parlar. Sash fastenings.
2276. B. Smith, B. Brooks, and J. Smith. Lights.
2279. R. A. Brooman. Weighing and measuring grain. (A communication.)
2282. C. Sutton. Indicating the position of sunken ships or other vessels.
2283. H. Dixon and J. R. Renner. Carbonizing vegetable substances.
2288. R. Waller. Manufacturing and refining saccharine substances.
2289. W. Wheatstone. Musical instruments.
2292. F. Barnett. Electric signals.
2296. S. Horsley and E. H. Jones. Cleaning and polishing boots and shoes.
2302. W. E. Gedge. Drying grain. (A communication.)
2304. T. Meriton. Steering apparatus.
2313. W. Tuxford. Thrashing machines.
2316. F. Barnett. Improvements in lighting.
2319. G. Davies. Nails. (A communication.)
2320. J. and W. Statham. Mowing and reaping.
2321. J. Lee and B. D. Taplin. Traction engines.
2323. G. White. Filtering or purifying liquids. (A communication.)
2327. H. Wickens. Reaping and mowing machines. (A communication.)
2328. E. Partington. Manufacture of paper.
2331. J. Clough. Preparing fibrous substances.
2345. S. Hawksworth. Floor-cloth.
2351. J. Oliver, J. Grantham, W. Sinnock, and M. R. Leverson. Obtaining certain chemical substances.
2376. J. Price. Permanent way of railways.
2377. J. Jacob. Obtaining and treating hydrogen gas. (A communication.)
2381. G. J. Gladstone. Disengaging boats.
2389. J. Musgrave. Application of steam power.
2412. W. Clark. Manufacture of peat. (A communication.)
2422. J. A. Knight. Pumping engines. (A communication.)
2170. T. Evans. Manufacture of boots and shoes.
2175. P. Knowles. Opening and cleaning fibrous materials.
2597. C. D. Abel. Manufacture of white lead and vinegar. (A communication.)
2628. P. Fenton. Treating fibrous substances.
2648. H. Keach. Manufacture of segars.
2653. M. A. F. Mennons. Ascertaining the presence and degree or cessation of vitality in the human body. (A communication.)
2802. T. C. Darby. Horse hoes.
2803. R. Dobson and J. Clough. Combing, preparing, and spinning fibrous substances.
2970. W. Sellers. Apparatus for sewing.
2990. W. Clark. Clasps or fastenings. (A communication.)
3067. T. Lawes. Quilts and coverlets.
3122. R. Ashworth, G. Shepherd, J. Cormack, and J. Dearden. Looms.
3130. T. Walker. Indicating the speed of vessels.
3160. J. W. Chalfont and D. Keys. Winding watches and chronometers.
3208. W. M. Williams. Treating bituminous minerals.
3209. W. L. and W. Allchin. Superheating steam.
3252. J. P. Dormay, J. S. Aikenhead, and T. Johnson. Boats.
3256. G. H. Birkbeck. Raising or forcing fluids. (A communication.)
3460. W. Tongue. Manufacture of woven looped and bobbin net fabrics.
3262. W. Tongue. Umbrellas and parasols.
1. J. M. Rowan. Railway wheels.

LIST OF SEALED PATENTS.

Dated Jan. 17, 1862.

1821. W. and P. H. Savery.
1823. R. A. Brooman.
1829. W. Price.
1830. R. Thatcher.
1832. J. Platt and J. Bockley.
1836. C. N. Kottula.
1841. J. Beattie.
1843. G. F. Griffin.
1862. H. Cook.
1937. F. Richmond, H. Chandler, & W. B. Ritchie.
2618. F. J. Evans.
2632. J. C. Healon and J. Dean.
2661. J. Chesterman.
2736. J. Wright.
2826. W. Tongue.
2842. W. Tongue.
2843. J. H. Johnson.

Sealed Jan. 21, 1862.

1844. T. Gray.
1845. N. E. Dumesnil.
1851. T. Hughes.
1859. R. Threlfall.
1863. W. Longmaid.
1865. B. Brown and R. Hacking.
1869. E. Haeffely.
1880. R. E. Garrood.
1881. J. B. Herbert.
1882. W. H. Harfield.
1899. T. S. Gressey.
1907. J. Rylands, T. G. Rylands, and P. Rylands.
1926. M. Pratt.
1956. W. Clark.
1964. M. A. F. Mennons.
2116. W. Clissold.
2243. R. O. White.
2314. B. Samuelson.
2535. J. Downs.
2840. W. E. Newton.
3046. C. S. H. Hartog.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

124. W. Craft.
129. W. H. E. McKnight.
130. P. A. Viette.
133. W. Betts.
137. J. Montgomery.
139. P. A. de S. S. Sicard.
143. R. G. Salter.
147. W. Newman.
155. R. Bradley and W. Craven.
156. W. Trotter.
160. P. A. Sparre.
163. J. Whitehead.
166. W. Poopard.
170. J. C. Reid and W. Milner.
190. C. O'Hara.
224. R. Bodmer.
227. J. White.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

106. G. Riley.
129. C. J. Dumery.
231. H. D. Pochin.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Jan. 18, 1862

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
[illegible]	0 3	1430	1 1	1445	1 4	1460	0 3	1475	0 3	1490	0 3
1416	0 3	1431	1 1	1446	0 3	1461	0 10	1476	0 7	1491	0 3
1417	0 3	1432	0 6	1447	0 10	1462	0 [illegible]	1477	0 6	1492	0 6
1418	1 0	1433	0 7	1448	0 3	1463	0 [illegible]	1478	0 3	1493	1 11
1419	0 3	1434	0 0	1449	0 3	1464	0 2	1479	0 4	1494	0 3
1420	0 11	435	0 3	1450	1 4	1465	0 5	1480	0 9	1495	2 4
1421	0 7	1436	0 8	1451	0 3	1466	0 2	1481	0 3	1496	0 8
1422	0 3	1437	0 1	1452	0 8	1467	0 3	1482	1 1	1497	0 3
1423	0 10	1438	0 7	1453	0 10	1468	0 3	1483	0 3	1498	0 [illegible]
1424	0 3	1439	1 7	1454	0 7	1469	0 [illegible]	1484	0 3	1499	0 1[illegible]
1425	0 3	1440	0 3	1455	0 6	1470	0 7	1485	0 3	1500	0 0
1426	0 9	1441	0 9	1456	0 3	1471	0 6	1486	0 7	1501	0 9
1427	0 3	1442	0 10	1457	0 6	1472	0 11	1487	0 10	...	...
1428	0 3	1443	0 3	1458	1 3	473	0 10	1488	0 10	...	...
1429	0 8	1444	0 2	1459	0 3	1474	0 3	1489	0 3	...	...

PRICES CURRENT OF METALS.

London, Jan. 23, 1862.

		£ s. d.		£ s. d.	p.ct
IRON:					
Rails in Wales and North of England	pr. ton	5 5 0	to	6 0 0	nett
Welsh Bars, in Wales	,,	5 5 0	,,	5 7 6	3
Staf. Bars, at the Works	,,	6 10 0	,,	7 5 0	2½
,, Hoops	,,	7 10 0	,,	8 0 0	,,
,, Sheets, Singles	,,	8 5 0	,,	9 0 0	,,
,, Nail Rods	,,	5 15 0	,,	6 10 0	,,
,, Boiler Plates	,,	0 0 0	,,	8 10 0	,,
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 7 3	,,	2 8 4	nett
Do. No. 1, Good Brands	,,	2 8 0	,,	2 15 3	,,
Scotch Bars	,,	7 5 0	,,	7 15 0	,,
Swedish Bars, in London	,,	10 15 0	,,	11 0 0	,,
COPPER:					
Sheet and Sheathing	per lb.	0 0 11	,,	0 0 0	3
Tough Cake and Tile	pr. ton	98 0 0	,,	0 0 0	,,
Best Selected	,,	101 0 0	,,	0 0 0	,,
Australian	,,	102 10 0	,,	0 0 0	,,
South American	,,	0 0 0	,,	0 0 0	,,
Yellow Metal Sheathing	per lb.	0 0 9½	,,	0 0 0	2
STEEL:					
Swedish Keg	pr. ton	15 0 0	,,	0 0 0	2½
,, Faggot	,,	16 0 0	,,	0 0 0	,,
TIN:					
English, Block	p. cwt.	6 1 0	,,	0 0 0	2½
,, Bar	,,	6 2 0	,,	0 0 0	,,
Foreign, Banca	,,	6 3 10	,,	6 3 0	net
,, Straits	,,	6 1 10	,,	0 0 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 7 0	,,	1 9 0	3
Coke, I.C.	,,	1 1 6	,,	1 4 0	,,
LEAD:					
Pig, English	pr. ton	19 10 0	,,	20 0 0	2½
,, Spanish	,,	18 5 0	,,	19 10 0	,,
Common Sheet	,,	21 10 0		22 0 0	,,
Tea ,, (Wimshurst's Patent) A special disct.	,,	36 0 0	,,	0 0 0	,,
SPELTER:					
On the spot	,,	14 5 0	,,	0 0 0	nett
For arrival	,,	18 10 0	,,	18 7 6	,,
ZINC:					
English Sheet	,,	24 0 0	,,	0 0 0	1
QUICKSILVER	pr. btl.	7 0 0	,,	0 0 0	3

TO INVENTORS AND PATENTEES.

MESSRS.
ROBERTSON, BROOMAN, & CO,
CIVIL ENGINEERS
AND PATENT AGENTS,
(Established 1823),
166 FLEET STREET, LONDON,
Undertake to obtain Patents for Inventions.
PROVISIONAL PROTECTIONS
APPLIED FOR.
Specifications Drawn and Revised.

ROBERTSON, BROOMAN, & Co.
"MECHANICS' MAGAZINE," AND PATENT OFFICE,
166 FLEET STREET, LONDON E.C.

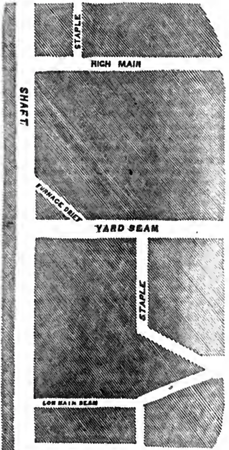
THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 31, 1862.

THE HARTLEY CATASTROPHE.

It will be some time, we hope, before the painful impression produced by the Hartley Colliery catastrophe will have passed away. We hope good is destined to come out of this great evil. This appears to be the order of things in England. There have been from time immemorial, manifest deficiencies in our coal mines. Common experience has pointed them out, philanthropy has pleaded for their removal, and science has suggested the means of removing them, but still they have remained, in defiance of experience, humanity, and common sense.

The Hartley Pit, which has recently witnessed a calamity unparalleled in the history of coal mining, is an old mine. It has three seams, as illustrated in the accompanying engraving, the high main, which is 38 fathoms from the surface, the yard seam, which is 65 fathoms deep, and the low seam, which is 90 fathoms deep. At the time of the accident, the men were working in the low seam. A single shaft, about twelve feet in diameter, connects these seams with the surface. This shaft is divided in two parts by a wooden brattice or partition. One part is called the up-cast shaft, through which the foul air of the mine ascends, and the other part is called the down-cast shaft, through which the pure air is communicated to the mine. There are also two staples, or little shafts, one of which is from the surface to the high main, and the other is from the yard coal to the low seam. Independent of the shaft, there is no communication between the yard seam and the high main. In the absence of this communication may be traced the proximate cause of the death of the men. Had a staple, or small shaft, passed between the yard seam and the high main, every man, excepting those killed immediately by the falling of the beam, most probably would have been saved. Now the question arises why did not such a staple exist? It was not because it had not been pointed out, or the disadvantages of its absence been felt. The proprietors and the miners who daily descended the shaft were well aware that the mine wanted a safety-valve. It is said that this staple from the high main to the yard seam might have been cut for about £200. It therefore could not be for want of money. Disguise the matter as we may, and dress it up in what verbiage we may, the truth is, there was not only shortsightedness but negligence of a most blameworthy character in not having such a staple cut. We know it is easy to be wise after the event, and almost any one can find fault. We know, too, that no harm was intended. No doubt the proprietors and the viewers of the mine would have sacrificed everything, including their own existence, to have prevented such a calamity. But the calamity has come, and it might, with ordinary care have been prevented. Somebody is to blame for this negligence, and it is for the jury at the coroner's inquest to pass an opinion. We call attention to this matter, not so much to reflect on the proprietors and viewers of the Hartley coal mine, but that steps may be taken *immediately* in other mines to open up such communications. We say immediately, because if attention be not directed to such obvious defects at once, the probability is that when the memory of the present calamity is weakened and when time has worn away the impression now stamped on every heart in the community, those most interested will be lulled into inaction, and things will remain pretty much as they are.



Though such an accident has not happened before, and it may be several years before a similar one occurs, it should be borne in mind that many lives have been lost, because there was only one shaft to many a mine. In 1835 a great explosion took place at Wallsend, when about thirty fathoms of the brattice were blown down. Out of 102 lives lost on the occasion, it was the opinion of Mr. Buddle, the viewer, that from 40 to 50 of them might have been saved had there been other means of egress. At the explosion at Jarrow many of the 40 lives lost might have been saved had there been a second pit. The same may be said of Heaton in 1815, where the mine got inundated, and destroyed 75 men and boys. It was subsequently found that they had entered a higher level in the mine; and where they waited for assistance, which never came. After feeding on their candles and horseflesh, they literally died of starvation. At Burradon, about two years since, 76 men and boys perished. It is said that at least two-thirds of them would have been saved had there been another shaft. But with all these warning voices, proprietors have worked without obeying the simple behests of duty. And now the whole heart of the nation is wrung with agony by this Hartley disaster. It appears that men will not act with common sense, though one should rise from the dead. How many more terrific accidents are necessary before we become sufficiently penetrated with the importance of the subject to take reasonable precautions?

It should be borne in mind that two shafts are not only necessary as means of egress, should accidents occur, but they are also essential for the efficient ventilation of mines. The late Mr. George Stephenson, in a communication to the South Shields Committee on accidents in coal mines, says:—"I think that the "ventilation of coal mines would be much "more certain if two pits were sunk instead of "one. The system in the neighbourhood of "Newcastle has been to sink one large shaft, "and to divide it into two, three, or four divisions, between the one and the other, being "only 5 inches of wood." The South Shields Committee on accidents in mines, in its report, as reprinted by the House of Commons, states. "That the imperfect state of ventilation in the "northern mines is caused by too few shafts in "proportion to the extent of underground "workings, and that in no case ought there to "be less than one ventilating shaft apportioned "to at the least, every 40 acres; and that no "winning or extraction of coal in a new mine "should be allowed to be made unless two "distinct and separate shafts have been "previously put down, which should be secured "by Act of Parliament."

Mr. James Mather (secretary of the same committee), in his report on the accident at Burradon, says:—"There is, however, a certain "and specific cure, which well applied would "remove the evils of Burradon. A new pit to "the rise seems to be essentially necessary for "carrying on these workings with safety and "success; its cost will probably be the cheapest "way of working the mine. Sooner or later "this measure will require to be had recourse "to, and better soon than late."

"Sink more shafts, sink more shafts," said Mr. Garforth, a coal proprietor, in his examination before the House of Commons, "I "have been acquainted with the subject for "sixty years, and I am satisfied nothing else "will do."

It is abundantly evident that for purposes of safety and ventilation no mine should be without two shafts. We admit, however, the difficulty of sinking them. Who is to pay the expense, the proprietors or miners? We consider that both should bear their equal proportions. We are averse to parliamentary interposition in such matters, if it can possibly be avoided. But rather than a crying evil should continue to exist year after year, imperilling the lives of thousands of men, we would gladly see an act of parliament passed making it obligatory that every colliery should have at least two shafts.

LECTURES TO WORKMEN.

Very different views as to the character of the instruction which it is most desirable to give to working men prevail amidst those who undertake the onerous duty of popular instructors. The general failure of literary, scientific, and mechanics' institutes, is too patent a fact to need any exposition. The great majority of these institutions have degenerated into cheap concert rooms, or places where comic entertainments can be enjoyed at a less cost than at the theatre. Political economists will perhaps say that the demand has created the supply; and that when a more solid article has been offered, there are no purchasers; or, in other words, that good and really instructive lectures fail to attract an audience.

It is precisely this statement that we are fully prepared to disprove. The character of the scientific instruction offered to working men at mechanics' institutes has rarely, if ever, been of such a kind as to be useful to them, and the have, consequently, held aloof. If we unde stand aright the wants of the mechanic, he demands information that he can turn to practical account. Disquisitions on the properties of the non-metallic elements, flashy lectures on combustion, "illustrated by brilliant experiments," may do very well for holiday audiences of school boys at the Polytechnic; but they are of no value whatever to a working man. Even when any more sterling course is attempted, it has rarely any direct practical bearing.

One of the best attended courses that we have seen lately was that of Dr. Percy on metallurgy, delivered at the Museum of Economic Geology. An audience of several hundred working men was assembled; many more tickets might have been disposed of had the capacity of the theatre been greater. The attendance kept up well until the very end of the course. All these circumstances prove that the appetite for instruction is of a healthy character.

But what was the nature of the information given? It was almost exclusively confined to a consideration of the modes of smelting copper and zinc ores, and of the intricate chemical reactions occurring when they are submitted to the various metallurgical operations.

Now, as certainly not five per cent. of Dr. Percy's audience ever saw, or are ever likely to see a copper or zinc mine, of what practical use could such a course be to the great majority? When Dr. Percy communicated a fact having a practical bearing, when he told the metal workers that sat before him by what means they could ensure a sound casting in copper, or how they could vary the character of the metal by the addition of small proportions of silicon, phosphorus, or arsenic; or proved to them that they could cast copper under water, it was wonderful to see the constrained attention of the men, and to witness the gratitude with which really useful information was received. The test of a good practical lecture to practical workmen appears to us to be this:—Ask any one of the audience of average intelligence as he leaves the lecture room, whether he has heard anything that will enable him to perform any operation in his calling in a better or more successful manner than before. If he has gained information that will enable him to do this, the lecture has been successful; if he has not, then it is a failure, even if it should have made him intimately acquainted with the details of the construction and the mode of working of all the zinc mines in Carinthia. Of the value of the information contained in Dr. Percy's course there can be no question; but the point at issue is, the question whether it be the kind of information suited to the wants of a London mechanic.

If we turn to a course of lectures of another kind, we find the same want of practically available information. The lectures delivered by Dr. Lankester, at the South Kensington Museum, have been published, and are, therefore, accessible to all. Let any of our readers turn to the part containing the "Lectures on Food"; let them read these lectures carefully through, and then ask themselves the question, whether there be any operation connected with dietetics, or culinary processes, which they can perform better than they could before reading the book. Does the chapter on bread give a single suggestion as to the manufacture or improvement of the staff of life? Or does that on cheese give the slightest indication of the causes of the difference between good and bad cheese, or the reasons by which the former may be secured, and the latter avoided?

From such failures as these lectures of Dr. Lankester, it is refreshing to turn to a lecture by a practical man, on the practical instruction of mechanical workmen. In June, 1859, Mr. Scott Russell delivered a lecture at Kensington, the subject being, "What should mechanical workmen be taught?" Mr. S. Russell treated more especially of the mathematical instruction required; he complained of the want of practical value in the course usually adopted. He stated that a facility of answering such a question as "how many yards of ribbon at 3½d. can be bought for 30s.?" was of no value to an artificer, however useful to a linendraper's shopman. He denounced the waste of time devoted to the first books of Euclid, and said there was not even a single decent text book of practical solid geometry; that the relations of numbers, the nature of curves, the doctrine of similar triangles, solid geometry, which has so much to do with conversion of materials, were never taught. The result of these errors in the education of the workman is that Mr. Russell had to import his most intelligent workmen from abroad, his best draughtsmen and mechanics coming from the Continent.

He further stated that men so practically educated would command at his works three guineas per week, and would probably rise to foremen, at £300 a year.

Surely there could be no difficulty in applying these remarks of Mr. Scott Russell to other than mathematical subjects. A course of lectures on those properties and qualities of the metals that render them useful to the workmen, would neither be difficult to write, nor expensive to illustrate. Mr. Wilson, we should opine, would not be at a loss should he attempt to give the numerous workmen at Price's Candle Company the practical chemistry of candle making; and the conversion of fat into the fatty acids by the action of the caustic alkalis, would be a subject of great and practical interest to the workers in a soap factory.

Abstract lectures on science are not of any use to the great body of the working classes. As a rule, they cannot possibly afford the time to study impractical matters; but they are always the willing and ready recipients of any information bearing on their every-day work.

METALS AND ALLOYS.

AMONG the most recently issued volumes of "Abridgments of Specifications," is one relating to metals and alloys. To the mechanical community, this will, we venture to say, be found extremely instructive and useful. We have before had occasion to speak of the valuable aid Mr. B. Woodcroft has given to intended patentees and others, by the publication of these abridgments. The idea of condensing and giving to the public in a portable and cheap form, the particulars relating to patents—the very pith and marrow of them, indeed,—was a most happy one, and happily has it been so far realized. Only those who have had occasion to ransack the archives of the Great Seal Patent Office, in times past, can fully appreciate the condensing process under which those archives have been put in order to educe the abridgments in question.

As may be imagined, the volume which contains a summary of the patents taken out for dealing with metals and alloys, is, in comparison with some of its companions, rather bulky. It would be idle to expatiate upon the valuable mineral products of this country, and especially those of a metallic nature, for they have been the theme of many a writer, and many an orator, and we know that they literally and morally lie at the root of England's greatness. The work of which we speak is eloquent to the same end, and it is curious to note the wondrously rapid development of inventive genius during the last years to which it refers, as compared with that of the first. Year by year as we approach 1861—and remarkably so for the ten or twelve years immediately preceding it—the patents taken out for different modes of obtaining metals from the ores, and of effecting combinations of metals, after they were separated from the grosser material, increase in number. They form, indeed, a record of the advancement of knowledge, and the ripening of scientific and practical skill, which is far more telling in its effect than any amount of rhetoric or oratorical skill.

The first patent noticed by Mr. Woodcroft, in this volume, dates the 20th September, 1623, and the patentee is one William Gomeldon. This invention is thus described:—"A perfect way, forme, and invention, for the smelting of lead oare, in great or large quantities, by means of a furnace invented by him, and by reason of some ingredient by him used, not formerlie used to that purpose in any of our domynions by any person whatsoever, otherwise than in small potts or crusibles, by which he is able to extract much more leade than formerlie hathe byne extracted by any thereby; alsoe to make useful and profitable such of our leade mynes, withen our realm of England, as at this serve for noe other use, but onlie to glaze poty." The invention, it may be said, relates to the use of sea coal, whereby great saving is to be effected by the preservation of wood and tymber "alreadie much wasted." The letters patent were granted for twenty-one years, and a royalty of 12d. per ton was to be paid to the king.

Step by step do we notice alterations, very effectual improvements made in the method of treating metals, and in mixing them, and the 480 pages of the "abridgment" are replete with information and interest for the thousands and tens of thousands who in one shape or another are dependent on the metal trades of the United Kingdom. Many well-known and distinguished names figure in the muster roll of patentees for metallic processes, and when opportunity and space offer themselves, we shall return to a consideration of metals and alloys

THE SCHOOL OF METALLURGY AND PRACTICAL SCIENCE FOR SHEFFIELD.

THE science of metallurgy, too long and too generally neglected in this country, is likely to receive more attention in future than has hitherto fallen to its lot. We have recently borne testimony to the strong desire which exists amongst the working men of the metropolis to receive instruction from Dr. Percy's lectures on that science at Jermyn Street. Last week a meeting was held at Sheffield to promote the formation of a school of metallurgy and practical science in that town. Certainly this step was not taken before it was required. If the speakers at the meeting are to be relied on as authorities, Sheffield pre-eminently needs scientific instruction. We have been led to suppose that the artificers of that town were equal, if not superior, to any in Europe. This it appears is a mistake. They not only lack practical knowledge, which lies at the foundation of their manufactures, but they are behind the skilled workmen of many towns of the Continent. The Mayor of Sheffield (Mr. John Brown, of the Atlas Works) said that he had constant evidence of the need of such a school, as the manufacturers of Sheffield experienced serious disadvantages, daily, from the ignorance of men to whom they were compelled to entrust work requiring a knowledge of metallurgy. The rule of thumb was too frequently adopted: managers of manufactories were deficient of scientific knowledge, and our continental neighbours were in some respects in advance of us, In German manufactories professors were employed to superintend certain classes of work. Mr. Edward Vickers, a master manufacturer, bore similar testimony to the superiority of German artizans, and he expressed his opinion that the continental manufactures would make Sheffield work look exceedingly small in the Exhibition of 1862. From the preparation that Germans and Rhenish Prussians were making, he felt certain they would produce steel manufactures with which it was useless for Sheffield to attempt to compete. He attributed this state of things to the want of scientific knowledge and practical engineering in every large manufactory of Sheffield. Even Mr. Roebuck, who is generally disposed to snarl at everything that is not English, was obliged to admit that Sheffield was behind some continental towns.

After allowance is made for the language of exaggeration, it is pretty evident that Englishmen, who generally have such an amazingly good opinion of themselves, can learn something from foreigners, and the sooner we commence in earnest to make good our manifest deficiencies, the better for our reputation and our interests. The establishment of a school of metallurgy and practical science in such a centre of industry as Sheffield, will lead to an improved state of things. But we can scarcely believe that town to be so far behindhand as some of its most respectable citizens imagine; neither do we think that the Exhibition of this year will show in so decided a manner the inferiority of its products. The very idea of lagging behind will foster the zeal and sharpen the wits of the people of Sheffield.

But admitting Sheffield to be as it has been depicted, what are the causes that have produced this state of things? The speakers at the public meeting attributed it to the want of scientific knowledge among the managers of factories. The *Times* traces it to a desire to buy in the cheapest market. The rage for cheap things, says that paper, has induced manufacturers to sacrifice quality to quantity. No doubt there is some truth in this statement. The *Times*, however, labours under a mistake when it considers "London-made" cutlery so much superior to Sheffield cutlery. Many of the wares which pass for "London make" come from Sheffield. Sheffield trade marks are frequently imitated, or rather pirated, by continental manufacturers. This is an evidence that Sheffield is not in such a forlorn condition as some have supposed. There is, however, much room for improvement, and the step taken is certain to lead to beneficial results. We hope, therefore, that the school of metallurgy and practical science about to be established at Sheffield will be the forerunner of similar schools in different parts of England; and when they are established, we hope managers and lecturers will take some hints from our article on "Lectures to Workmen" in another column.

ON FUEL.

ARTICLE II.—WOOD.

THE value of wood as fuel cannot be correctly estimated without reference to its chemical composition. If a small portion of perfectly dry wood be placed in a long glass test tube and heated gently, without charring, in the flame of a spirit lamp, it will be found to give out a very considerable proportion of water, which will condense in the cool part of the tube; the amount usually varies from eighteen to twenty per cent of the original weight. The dry residue that remains consists of organic or vegetable and inorganic or mineral matter. The vegetable matter is of two kinds, the lignine or woody fibre, and certain accessories which vary greatly in different woods; thus, in the oak there is tannin, and in plants of the fir tribe a considerable amount of resinous matter, which adds greatly to the inflammable character of the wood.

The mineral matter which is left as ash after complete combustion, varies also very greatly both in quantity and composition in different woods. Thus, willow gives two per cent. of ash. Beech and fir average about one per cent. The ashes of the beech contain fifteen per cent. of potash, those of the Scotch fir about less than two per cent. of this valuable alkali. Perfectly dry wood, from which the water has been expelled by long exposure to a heat of 140° C, contains on an average half its weight of carbon, united with hydrogen and oxygen, the latter two elements being very nearly in the proportion to form water; taking the average of a large number of experiments, the quantity of hydrogen in dry wood may be stated at six per cent., the quantity of oxygen being about forty-one per cent. As hydrogen unites with eight times its weight of oxygen, it is obvious that the hydrogen is in excess, or in other words, supposing the hydrogen and oxygen of the wood to unite during combustion, there would remain a proportion of hydrogen which would require for its combustion a certain amount of atmospheric oxygen, and this proportion only would possess any calorific value.

In a practical point of view, wood cannot be regarded as ever free from water, of which, as before stated, the driest specimens always contain nearly, or quite, one-fifth of their weight.

As the amount of water existing in fuel greatly affects its calorific value, the subject is one of great practical importance, the whole of the water existing in wood has to be volatilized during combustion, rendering a large amount of heat latent, hence the drier the wood the greater is its available calorific power.

The quantity of water in wood varies considerably with the season during which it is felled, in summer the sap is present in great quantity, rising to supply the rapid evaporation that takes place from the leaves; in winter, on the contrary, there is a much less amount present, but it increases rapidly towards the spring.

Thus the wood of the common hazel felled during January, contains 40 per cent. of water, which increases to 49 per cent. by the commencement of April.

The wood of the ash contains 28 per cent. in January, and 38 in April.

Exposed to dry air for a lengthened period, wood loses the greater part of its natural moisture, always retaining from 18 to 20 per cent., however perfectly it may have been air-dried, and even after this residuary water has been expelled by exposure to long continued artificial heat, it is rapidly re-absorbed again on exposure to the air, until the wood regains the quantity it naturally possessed in the air-dried state.

The drying of wood by the atmosphere is a subject of considerable importance, and many experiments have been made to determine the circumstances under which it takes place most rapidly. Dr. Percy quotes some interesting details from Af Uhr, who has proved "that "the desiccation of wood by exposure to the air "is much promoted by removal of the bark. "Trees were felled at the same time in June "after the sap had risen, and the wood was "left to dry under cover during the four fol"lowing months, it was in pieces of unequal "length and diameter, of which some were "barked, and others left with the bark entire. "His results are recorded in the following "table:—

	Loss per cent. of the original weight of the wood.			
	July.	August.	Sept.	October.
Barked Stems	34·53	38·77	39·34	39·62
Unbarked Stems.........	0·41	0·84	0·92	0·98

The wood of the youngest branches contains much more water than that of the trunk and older branches.

The timber of plants grown in exposed situations is much drier and more valuable than that of dense forests, the reason for this is evident; the power to decompose the carbonic acid of the air, and fix the carbon in the tissues of the living vegetable depends on the exposure to solar light, the superior value of the wood of isolated trees is well-known to the shipbuilder, and its greater worth as fuel is in equal proportion.

Dr. Percy gives the following valuable summary of practical directions for the cutting and storing of wood intended to be used as fuel:—"The trees should be of mature growth, and "should be felled when most free from sap; "the wood should be cut to suitable lengths "and should be stacked so as to allow the air "freely to circulate through the pile, in order "to promote desiccation as much as possible. "If uncleaved in the direction of its length, it "should be previously deprived of its bark, "either wholly or partially, by taking it off in "strips all round. It should be protected from "wet and rain; if transported to a distance "in rafts, it should not be left in the water "longer than absolutely necessary, because ex"perience has proved that its value as fuel "deterioriates by long soaking."

ON COMPARING AND ANALYSING THE FORMS OF SHIPS.

BY MR. ROBERT MANSEL.*

THE paper to be brought before you this evening, on the "Comparing and Analysing the forms of Ships," will find an appropriate and useful, though somewhat lengthy, introduction in the statement and consideration of some elementary principles directly affecting the subject. The mode of calculating the various elements may equally admit of exposition. It will be my endeavour to exhibit the reasons of these without reference to any very refined mathematical investigations. These. however excellent in themselves, are, in my opinion, very often sadly misplaced, and we find simple subjects so involved in mathematical symbols as to be totally unintelligible to those for whom they are ostensibly written.

Defining a ship as a water-borne mechanism by which, subject to necessary conditions, a given cargo may be transmitted from one place on the earth's surface to another, it is understood that this transmission is effected in a restricted time; or, in other terms, that the speed is regulated by human intelligence directing into certain channels *power* obtained from natural sources. Thus, we design the sails of a ship so that they shall deprive moving masses of air of a portion of their velocity; the power involved in this variation of velocity being almost simultaneously re-expended upon work done upon the various fluid resistances to the motion of the hull. Similarly we develope heat in the furnaces of a steam vessel. A varying proportion of this heat goes to the formation of vapour, strictly speaking, as a means whereby a varying proportion of the heat may be transformed into power, as in the former case, to be expended, part upon unavoidable sources of waste. and the remainder upon work done upon the fluid resistances.

A ship, we say, is a machine in which power is applied to the performance of work; the material of that machine we, to the best of our judgment, select and fashion so that from the given natural source the greatest possible amount of power shall be obtained, and when so obtained, that, by its expenditure, the greatest possible amount of useful work shall be done. In a sailing vessel we have but a very rude idea of the power actually obtained, and little more of how it is expended. In a steam vessel the coal consumed gives a first approximation to the power which is being developed. The gross indicated power obtained, compared with this consumption of coal, ought to furnish the comparative excellence of the boiler and engine, due weight being given to other conditions, such as safety, weight, bulk, and durability. But this gross indicated power must also be diminished by necessary sources of waste, such as friction of and working the engine, friction of the load, friction and slip of the propeller; these may be approximately valued, and, when deducted, leave a large residue which must be accounted for in work done upon the fluid resistances proper to the motion of the hull.

---

*Read before the Scottish Shipbuilders' Association, Oct. 7, 1861, Robert Barclay, Esq., president, in the chair.

When we have thus arrived at some idea as to the gross amount of these resistances, if we endeavour to proceed a step farther, and try to separate them, and elicit the laws by which they are governed, we immediately meet with the most perplexing contradictions and differences of opinion amongst these who try to decipher the laws by which those apparent contradictions are reconciled. Mr. Scott Russell, when discussing this subject before the Institute of Naval Architects, appears to have considered the displacing of the water in the path of the ship as the direct and principal resistance. He remarks, "The first inevitable motion of the water is one so great in amount that it is not easy to reconcile its real magnitude with our ordinary experience and observation. The work which the moving power of a ship has to do is to excavate the water out of the whole way along which the ship moves." Mr. Scott Russell illustrates this by an example, and then goes on to state, "This gives us the first principle to be adopted in the construction of a ship intended to waste little power. It should have to excavate a small channel," or, as he explains, give the vessel length with a small immerged mid-section; but this is qualified by the remark that this principle is very much limited, when applied to practice, by other conditions and qualities required in a ship. The other condition which appears specially noticed is the filling up the canal when the vessel has passed; and, at the conclusion, "But the resistance which the vessel experiences from the sticking of water to the skin in a most formidable element of resistance." Mr. Scott Russell then, in common with many other writers, recognizes fluid friction as an important element of the resistance; but there are others who assert that in well-formed vessels this element constitutes the entire resistance. For example, in a paper recently read before the British Association, by Dr. Macquorn Rankine, of our university, it is alleged that a correct valuation of the frictional resistance in certain vessels, well-shaped for their respective speeds, leads to the conclusion that the whole of the disposable power must have been taken up in overcoming the frictional resistance, and hence, with such ships, there is no other resistance. Dr. Macquorn Rankine has framed formulas on this supposition, and he offers the close correspondence of the theoretical deduction with the results of actual trials of a number of vessels, in corroboration of the accuracy of the theory.

In the *Artizan* of September, 1857, will be found a letter in which I have questioned the truth of the foregoing doctrines, as advanced by Mr. John Bourne. In that letter, while freely admitting that fluid friction formed a most important element of the resistance, and that no formula with pretensions to accuracy could ignore its definite statement, at the same time, I denied that it formed the only, or even the most important, element; or that in our approximate practical formulas the immerged surface or frictional element would form a better measure of the resistance than the mid-area or water-displacing element. I have failed to discover any valid reason for modifying the views thus expressed, and referring to the *Proceedings* of this Association for March last, you will find some explanations by which it was endeavoured to be shown that in a screw steam vessel the frictional element ought not to have the same prominence as it would have in a similar paddle vessel. I corroborated this view by the table published at page 130, showing that the simplest and best known approximate formula, by eliminating the most obvious source of waste, namely, the slip, gave the relation between the power and the speed with great accuracy, and without the least reference to the frictional element of the resistance. In illustration, take the Fairy and Rattler, which happen to appear in both tables. Dr. Macquorn Rankine's deduced co-efficients are 20,770 and 19,360 respectively, their difference 1,419, or about $\frac{1}{14}$ the less. By my table the co-efficients are 72.000 and 74.335, their difference, 2.335, or about $\frac{1}{31}$ the less, a still closer result. Notice, it is not absolute values of the co-efficients which are to be looked to, but merely their comparative values with each other; a perfect theory would give the same co-efficients for all vessels. However this may be, Dr. Macquorn Rankine's known abilities entitle his deliberately stated deductions on this most difficult subject to the most careful and respectful consideration of those who may chance to differ from him in opinion; and the subject is certainly far too extensive to enter upon at present. Nor in what follows will I have time to enter into any lengthened description or historical details. For the latter I refer you to the very excellent digest which forms the introduction to the late Mr. Fincham's "History of Naval Architecture," in the opening sentences of which this author has pertinently remarked:—"It was not only during the earliest ages of the employment of ships that the art of building them had to be carried on separately from the aid of science in their construction, but this state of things has marked almost the entire course of history. If we turn back to centuries that have passed away, we perceive that ships have been built much in accordance with the taste of ages respectively, determined ultimately as mechanical skill was able to give a good or only an indifferent effect to the designs of constructors. But there were tastes proper to countries as well as to periods, marking a state of rudeness or of comparative refinement, long before anything like a scientific basis was laid for so important an art. The development of art *never waited for this basis*, necessity impelled it onward, and along with many errors it always associated some important truths, and gathering on the side of truth and rejecting on that or error, a long course of experience produced ships of a high degree of excellence, and capable of fulfilling the objects of their respective periods before any theory of naval construction existed, perhaps fully as much to the satisfaction of those who built and of those who commanded them as ships of the present age fulfil their destinations." Concisely stated, we may say, shipbuilding as an art has preceded shipbuilding as a science. The many principles involved in the practice of that art, could they only be eliminated, systematically arranged, and their relations defined, would constitute the science. Unfortunately, some of the most important principles, though indicated, are far from being established; others, again, have been long known, and I now propose to discuss the few which, under the name of "necessary conditions," were specially referred to at the commencement of this paper.

The first great principle, due to Archimedes, recognises the well-known fact that the gross weight of a floating body is precisely equivalent to the weight of a portion of the sustaining fluid of the same volume as the immerged part of the floating body. This principle involves, or is implied in, several others.

First. The pressure of the fluid at any point, is proportional to the depth of that point from th free surface of the fluid.

Second. At the said point the pressure is the same in all directions.

Third. The pressure exerted upon a point of an immerged surface is perpendicular to the surface. Let P (Fig. 1) be a point on the immerged surface of a vessel, draw a line $P\ R$ perpendicular to the surface and equal to its depth of the point from the water-line. It will represent, in direction and magnitude, the pressure upon the point; and, by the principles of statics, is equivalent to the horizontal and vertical components $H\ P$ and $V\ P$ respectively. Instead of a point consider a small surface; the same holds for every point of the surface, and it will be seen that the effective area upon which the collective vertical pressures act is diminished by the inclination of the surface to the water-line in precisely the same ratio as the vertical component pressures are less than the actual pressures perpendicular to the surface. Hence the upward pressure upon the small area is precisely the same as the weight of the little column of water which would stand upon the area and reach perpendicularly to the water-line. The same occurs upon every other portion of the section; and hence the entire upward pressure is equivalent to the weight of the portion of fluid which would fill the cavity to the water-line. The horizontal components need not be considered; being necessarily equal and opposite, they produce no effect further than a crushing-in pressure upon the sides.

The above principle must be understood in a purely statical sense, or when ship and water are both at rest. Should either be in motion, the principle is slightly affected, and in certain positions, when pitching and rolling, the divergence, with certain forms, becomes very marked indeed.

The determination of the volume of a ship to one or more immerged depths is, therefore, a necessary and important calculation, as we may thus arrive at the depth of immersion of the vessel when her weight of hull and cargo are given; and further, when those weights are distributed so as to fulfil another necessary condition. Thus, the effect of the fluid pressures have been shown equivalent to a definite amount of upward vertical pressures, these have a centre through which their resultant, equal to the weight of the hull and cargo, may be supposed to act, and being in position no other than the centre of gravity of the immerged volume, is appropriately named the *centre of buoyancy*. Again, gravity acting upon matter of the hull and cargo constitute an equal and opposing set of parallel pressures, which, by an obvious mechanical principle, cannot possibly balance unless their resultant centre, or *centre of gravity*, is situated in the same vertical line as the *centre of buoyancy*. Hence it is that, if we assume a certain water-line for a ship, and calculate the fore and aft position of the centre of buoyancy, any distribution of the weights on board which does not give their centre of gravity in the same fore and aft position is immediately followed by an alteration in the water-line till this condition is fulfilled.

The immerged volume and water-line of a ship being thus defined, the next important question is in regard to the amount of stability in this and adjacent positions. *A priori*, we cannot say what should be the amount for a proposed vessel, but, by comparison with other tried vessels, we may, with the aid of first principles, arrive at safe conclusions as to the amount of stability which experience has found advisable, and whether the proposed vessel is likely to possess this quality in the necessary degree. Two modes of effecting this comparison are usually given in works on naval architecture—the first, called the *metacentric* method of Bouguer; the second, Atwood's method, as given in a paper published in the Royal Society's *Transactions* for 1798.

The mechanical principles in both appear to be identical, and, to a certain extent, inaccurate. I would describe the first method as the production of one who, understanding the practical difficulties of the subject, treated it in what appeared to be the simplest way applicable to bodies shaped anything resembling what a ship ought to be. Atwood's greater generality is due to the application of his method to forms with which the naval architect should have little concern, and by the introduction, as a definite factor, of the height of the centre of gravity of the hull and cargo. This element, however important, is far too troublesome to calculate directly, and, as a rule, is either vaguely guessed at or found by experiment after the ship is built and laden. Mr. Fincham has remarked, "It is not obvious that the metacentric curve is of any value," also, "that the principles upon which the moment of a force to keep a floating body deflected at any given angle can be calculated were well-known before Bouguer wrote." I agree with this, and think further that Bouguer's metacentre, with Atwood's improvements, are only variations on a problem which, directly investigated on the mechanical principles involved, is very simple indeed. Suppose a vessel (Fig. 2) floating upright on the water-line $A\ B$, and that by the action of a horizontal pressure she is retained in a position such that $C\ D$, at an angle a° with the former, is the water-line. The wedge-shaped solid I is immerged on the one sipe, and the corresponding sold E is withdrawn on the opposite. Now, if the fluid pressures upon the respective sides balanced when the vessel was upright, this can no longer be the case when an amount of pressure corresponding to the weight of the wedge section of fluid is added on the one side and withdrawn from the other. The effect of this difference, measured by its moment, tends to restore the vessel to her first position, and is the stability-giving element of our problem. Hence I and E, being the weights of the volumes of fluid forming the wedge shaped solids, and l the distance of their centres of gravity from the middle, their moment $= (I + E)\ l$.

Again, any body whatever, floating or not, of the weight of W, and having its centre of gravity at the height of d above the point of support, will, if deflected through the angle a, be subject to a moment tending to throw it down, measured by the product $W\ d \sin a$.

This is the stability-destroying element of the problem—the difference of the former and this is the measure of the stability of the ship at the given angle of inclination; or denoting this by the symbol S_a we have:

$$S_a = (I + E)\ l - W\ d \sin a. \ldots\ldots\ldots (1.)$$

Obviously, the values of I, E, and l, diminish as we proceed from midships to the extremities; and it is understood that it is the average values of these elements throughout the water-line which enter the formula. In general terms, if we call y the half-breadth, the areas of I and E are very approximatley $\frac{1}{2}\ y^2 \sin\ a$, while the length of l is $\frac{2}{3}\ y$ very nearly. Hence, for a little piece, $d\,x$ of the length of the water-line, the product $(I + E)\ l = \frac{2}{3}\ y^3\ d\,x \sin a$; and for the whole water-line $= \frac{2}{3} \Sigma\ y^3\ d\,x \sin a$; the symbol Σ merely denoting the sum of the like small elements throughout the length of the water-line; and, hence, (1) may be written:

$$S_a = (\tfrac{2}{3} \Sigma\ y^3\ d\,x - W\ d) \sin a. \ldots\ldots\ldots (2.)$$

The product $\frac{2}{3} \Sigma\ y^3\ d\,x$, is generally known as the *moment of the water-line*; or strictly speaking, its *moment of inertia* round the middle line. It is easily obtained by the well-known method of cubing the half-breadths, measured at equi-distant intervals, and taking the resulting numbers as similarly placed ordinates of a curve, having the given water-line as base, and its area, the required value in cubic feet of water; that is, supposing one foot to be the unit of length. Having determined the foregoing element W, the displacement, and the height of the centre of buoyancy, if we knew d, the height of the centre of gravity above the last centre, we should have all the elements for calculating the moment of stability, according to equations (1) or (2). Unfortunately d, as a rule, is unknown, and we endeavour to arrive at some notion of the comparative stability without it. Take Bouguer's method, and, in effect, we ask what value of d would make the stability vanish? Obviously, this takes place whenever the product of the displacement into the line d is equal to the moment of the water-line; or, $W\ d = \Sigma\ y^3\ d\,x$; and consequently:

$$d = \frac{\frac{2}{3} \Sigma\ y^3\ d\,x}{W}.$$

Hence, this line being calculated and laid off at its proper height above the centre of buoyancy, indicates the limit below which the centre of gravity must be found, if the vessel possess any stability. The limiting point is named the *metacentre*. Its height above the centre of buoyancy, multiplied by the displacement, or its equivalent, the moment of the water-line, is often taken as the comparative measure of the moment of stability.

Equation (1) is precisely the same as that given by Atwood. It differs from (2) merely in employing the actual calculated values of I, E, and l, instead of the approximate expression, $\frac{2}{3} \Sigma\ y^3\ d\,x \sin a$; but for reasonably constructed vessels, and ordinary deflections, the difference is very trifling. For example, in Morgan and Creuze's papers, reference is made to two vessels, the calculated stabilities of which, at 10° of inclination, by Bouguer's method, were 1,736 and 205; by Atwood's, the numbers were 1,729 and 208 respectively—the difference arising from the sides of the vessel between the limits of immersion and emersion not being circular arcs. But again, the mere fact that a vessel is proposed of a form that renders it necessary to apply Atwood's method to obtain the amount of these solids correctly, opens up another question, leading to a direct denial of the propriety of building such a vessel. Thus, about 165 years ago, Paul Hoste indicated that the rolling motion of a ship would be uneasy in proportion to the extent that its form about the water-line would justify the application of Atwood's method in preference to that of Bouguer—a deduction very much in consonance with experience, as well as theory. In illustration of this, referring to Peake's *Rudimentary Treatise*, we there find a comparison between the war ships Canopus and Vanguard, in respect of their solids of immersion and emersion, when deflected 7°. The important element in the explanation of the easy motion of the first ship, as compared with the second, being the slight difference between these solids in the first ship as compared with the second.

Atwood's method of investigation is briefly as follows:—He writes, "The stability of a vessel is truly measured by its weight, and the distance between the vertical lines which pass through the centre of gravity of the vessel, and the centre of gravity of the immersed volume." It is supposed that these centres are known, and the distance between them invariable, and equal to d.

Referring to Fig. 3, D_1 is the position of the centre of buoyancy when the vessel is heeled, and G_1 the point where the perpendicular through the centre of gravity cuts the line $D\ D_1$ joining them. The foregoing proposition, consequently, gives for the deflection a°; moment of stability $= W \cdot D_1\ G_1 = W\ (D\ D_1 - D\ G_1)$.

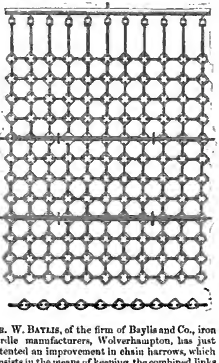
But $W \cdot D\ D_1 = (I + E)\ l$; because, by the property of the centre of gravity, the moment of shifting the centre of buoyancy from D to D_1 is an effect of, and precisely equivalent to, the moments of the wedges I and E.

Also, since $D\ G_1 = D\ G \sin a = d \sin a$, the preceding may be written, moment of stability $= (I + E)\ l - W\ d \sin a$, which is the same expression as obtained formerly.

(To be continued in our next.)

It is proposed to erect a Crystal Palace in Paris on the plan of that at Sydenham. A company with a capital of 25,000,000fr. is in course of formation; Sir Joseph Paxton is at the head of the architectural department, Mr. Edwin Clarke is appointed consulting engineer, and Mr. Thomas Brassey is to be the contractor. The building will be erected in the Bois de Boulogne.

BAYLIS'S PATENT CHAIN HARROWS.



Mr. W. Baylis, of the firm of Baylis and Co., iron hurdle manufacturers, Wolverhampton, has just patented an improvement in chain harrows, which consists in the means of keeping the combined links forming the chains fully extended; this is effected by the use of a suitable number of thin strips of steel, iron, or other suitable material sufficiently elastic or pliable, that as the harrow is drawn over or obliquely across ploughed land it shall readily adapt itself to the inequality or unevenness of the surface over which they pass. These strips may be readily inserted transversely or at right angles with the length or draftway of such harrows, the extending strips being so constructed as to readily admit of their being united or held to the outer links as shown in the plan-view of the above engravings. The number of such transverse elastic stretchers may be varied as desired or found necessary; and the intermediate links through which such elastic strips pass may be variously formed, either for inserting the strip, or to open with a pin or shackle joint for receiving them. In some instances the last row of links is made of a triangular shape, as represented in the lower figure, the base line of which is horizontal to the ground over which they pass, or they may be made of any other like shape calculated to produce the desired object, which is to further smooth or level the land as the harrow passes over it.

TROTMAN'S STEERING GEAR.

If the best mode of steering vessels be not soon adopted it will not be the fault of inventors and inventions. The whole question is now being thoroughly discussed. There can be no doubt that our large vessels and improved naval tactics demand an improved system of steering. The accompanying illustrations represent a plan invented by Mr. Sandars Trotman, of Albert Street, Camden Town. *A* steam cylinder; *B* piston; *C* connecting rod; *D* hydraulic cylinder; *E* piston; *F* connecting rod; *G G* cross-head; *H H* spring-break set in cross head; *I* lever attached to rudder-shaft; *K* rudder-shaft; *L* friction roller; *M* inlet to steam chest from boiler; *N* exhaust to steam cylinder; *O* slide-valve to ditto; *P* valve gear; *Q* cog-wheel turned by the steering-wheel; *R* double-seated break-valve to hydraulic cylinder; *S* valve gear to ditto.

The inventor had the benefit of the experience of the late Capt. Harrison, of the Great Eastern steamship, and of Mr. McLennan, her chief engineer, in ascertaining the requirements of the case, and the objections generally to machinery as an auxiliary in the hands of the steersman. The

TROTMAN'S STEERING GEAR.

Fig. 1.

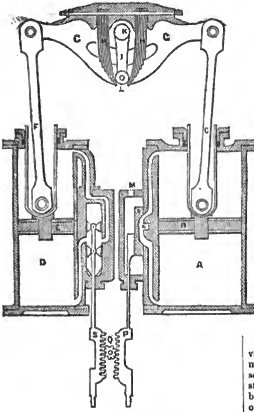


Fig. 2.

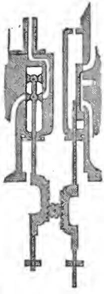
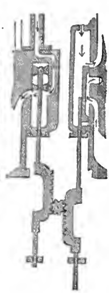


Fig. 3.



following are some of the requirements, and the mode in which they have been supplied, as stated by the inventor ;—

1st. A storm-wave striking the rudder while held by rigid machinery would inevitably carry it away. This danger is provided against by the spring break *HH*, Fig. 1.

2nd. It is necessary that the steersman should deliver the rudder over to its own free action at proper intervals. This is secured by the arrangement proposed, as when the valves are by the will of the pilot placed as in Fig. 1, the rudder is perfectly free to follow in the wake of the vessel.

3rd. The wheel has so long been the instrument in the hands of the pilot, that any system of levers (however effectual in regulating or controling a power) would be rejected by pilots generally. This invention constitutes the wheel an integral part of the apparatus ; so that the effect at present produced by manual labour can be secured by exactly the same movement on the part of the helmsman, with the absence of the labour now required.

4th. In steering a vessel (the steam not being up) the arrangement of this apparatus is such, that the ordinary system of hand-steering can be made available instantly by ungearing the steam apparatus and gearing the other.

The Spring Break—The rudder-shaft is shown in transverse section at *K*, and has attached to it, at right angles, the lever *I*. The rudder-shaft passes through and freely works in the cross-head *G G*, but is kept in a proper position by two powerful springs *H H* (fixed to the cross-head *G G*) acting on the lever *I*. In whatever direction, therefore, the cross-head moves, the rudder-shaft must move with it, on account of the lever *I* being retained between the two springs. The exceptional case, however, occurs when the cross-head is held rigidly by the cylinder, and the rudder is acted on by some undue force. Under such circumstances, the cross-head remaining stationary, the springs yield to the lever *I*, and all return to their original position, when the undue pressure is removed.

The Steam Cylinder.—The steam from the vessel's boilers is the power employed to give motion to the rudder. The steam is admitted somewhat in the same manner as in the ordinary steam cylinder, being introduced to the top or bottom, or entirely excluded at will, by means of a peculiar arrangement of the slide or *D* valve.

The Hydraulic Break.—This break consists of a cylinder and piston supplied with a valve, which opens or closes the thoroughfare from the top to the bottom of the cylinder. This cylinder being filled with water, the piston is only movable at the speed and to the extent permitted by the aperture made by opening the valve, allowing the water to circulate from top to bottom of the cylinder, or *vice versa*. It will thus be seen that the two cylinders, being coupled by the cross-head, act one upon the other—the one finding the power, and the other regulating it. The positions of the valves in Figs. 1, 2, and 3 show the following course of action. Fig. 1, break valve open, steam shut off from boiler, rudder free. Fig. 2 shows the second position of the valves ; the break valve is shut preparatory to the admission of steam ; and the still further movement of the valves shown in Fig. 3, admits the steam and opens the break valve to such distance as may be required ; the reversion of the wheel at once shuts off the steam, closes the break, and frees the rudder as in Fig. 1. The movement of the wheel in the opposite direction gives the reverse action to the machinery as also to the rudder.

THE SAFETY LAMP.

At a recent meeting of the Manchester Geological Society, Mr. George Charlton read a paper "on the Self Extinguishing Safety Lamp for Miners". After giving some individual instances of the thoughtlessness of miners, he went on to say that we have it in evidence that the recent accident near Wigan, where twelve lives were lost, and at the colliery near to Ashton-under-Lyne, where 41 lives were lost, in 1857, and also at the colliery near the city of Durham, in 1844, where 95 lives were sacrificed, were caused by lamps having been tampered with and unlocked by the colliers during their work, in the presence of inflammable gas. Several valuable additions have been made to the Davy lamps, to render them more safe and self-extinguishing ; and also to have the poles and oil vessel locked together, and stamped on lead with a die each time they were attached, or the locks sealed by other contrivances ; but the complexity of the arrangement and the expensiveness of their construction have hitherto prevented their becoming generally used. During the present year, Mr. Jones, of London, and myself have been closely engaged in inventing a piece of mechanism, of great simplicity, which can be readily adopted in any Davy, Stephenson, or Clanny lamp ; so that what good discipline fails to effect, our mechanical appliance does instantly and unerringly accomplish, by causing the workman to extinguish his own light the moment he attempts to open it, and so removes the inducement to tamper with his lamp. The invention consists in removing the ordinary lock from the bottom or outside rim of the lamp, and passing a screw-bolt through the brass rim, and also through two small pillars firmly into an extinguisher to a point, when it securely fastens the lamp. While the bolt is being screwed or turned from left to right, to lock the lamp, it gradually turns the extinguisher to the right side, to form no shadow ; but the moment the screw forming the lock is turned back from right to left, to open it, the extinguisher is infallibly brought upon the flame, and instantly puts it out. To prevent the ingenuity of a collier raising the wick above the extinguisher, to prevent its action, two pillars are placed in the oil vessel, one to sweep over the surface of the wick, to remove the snuff, the other to raise the wick one-fourth of an inch, but no further ; and we find that with wicks made of woven cotton one-eighth or one-sixteenth of an inch is sufficient for an ordinary day's work and use. Besides the above additions, is an improved burner has been introduced into the lamp, by which nearly double the light emitted by the ordinary Davy is produced. Those colliers who would so open their lamps are an exception to the general rule ; but, if there be only one or two such persons in a colliery they might cause serious accidents ; but such an arrangement as herein described would always prevent accidents arising from a contingency, and, moveover, they would no longer be tempted to tamper with their lamps, as they would then be at once detected.

Mr. J. Dickinson (the President) said it was desirable that the locks of safety-lamps should be as simple as possible. Complicated locks, such as Chubb's would never do for a safety-lamp. Mr. Waring, of Neath, had a patent lamp similar to that now exhibited. and which, on being exhibited before the South Wales Institute of Engineers, was opened by two or three in succession without unscrewing. There was a slight difference between the one now exhibited and Mr. Waring's : the pricker was only intended to act once—it could not be made to act so as to push the wick higher than a certain point.

THE LAWS OF COOLING.

A warm body, says the *Builder*, loses its heat by radiation from its surface, and by contact with cold surrounding substances. The laws of cooling have been long known, and are expressed in the formulæ of Newton and of Dulong and Petit. From their experiments, confirmed by subsequent researches of others, we learn that the heat lost by radiation varies with the nature of the exposed surface. Polished metal emits caloric much more slowly than wood or any rough material. We learn also that the heat lost by contact varies with the form and extent of the surface of the warm body, and with the excess of its temperature over that of the surrounding medium. A cube cools more rapidly than a globe of the same material, and of equal weight, because the surface of the former is larger in proportion to the mass than the surface of the latter. Red-hot iron becomes cold almost instantaneously when plunged into water ; whereas, if left in the open air, it might retain its heat for hours, or even days. When we know the temperature of the surrounding medium, the form of the body, its weight, and calorific capacity, we can easily determine its rate of cooling and its temperature at every instant. In practice, it is seldom, if ever, necessary to take into account the conducting power of the body itself. Bad conductors, when placed in a medium colder than themselves, may be warmer at the centre than on the outside; but this difference of temperature is slight and unimportant. Gold has nearly ten times the conducting power of lead, and nearly three times the conducting power of iron and platinum; but all these metals are subject to the same laws of cooling. The difference in the rate of cooling upon the outside and in the interior of a mass of gold, and of a similar mass of wood or iron, is a matter of no practical moment. The conducting power of a body cannot be measured except in those cases where its heat passes out of itself into surrounding substances.

An inclosed space like a room, office, or house, is subject to the same laws of cooling as a warm body of similar form, or equal bulk, and of equal calorific capacity. A room filled with warm air, and without any openings for currents, would lose its heat slowly through the walls, roof, and floor; so slowly, indeed, that a perfectly air-tight building filled with warm air would retain its high temperature inside for many months, even if carried in the depth of winter to Iceland or any other part of the frigid zone. The cold of winter pierces very slowly through our walls and roofs. It rises still more slowly from the ground. The most of our building stones conduct heat as rapidly as cast iron. The addition of layers of other materials outside and inside, such as mortar, wood, paper, &c., diminishes this conducting power, and reduces it in most cases so far that it may be disregarded. Snow, also, is well known to be a medium peculiarly impervious to cold: a roof covered with a coat of snow at 32 deg. is warmer inside than when it is exposed bare to the atmosphere at 32 deg. A very thin layer of mould protects vegetables from the frosts of winter, provided only the covering be impervious to the air. So, also, contrary to the ancient practice of raising thick partitions for securing warmth as well as safety, we find that the heat of the interior of a building is affected only in the slightest degree by the nature or thickness or the material which forms its exterior. In regard to our dwellings, where fresh, and, consequently, in winter, cold air is necessary to our existence, the whole subject of their warmth and healthfulness is reduced in practice to the regulation of the currents out and in, or their ventilation. In regard to ice-houses and similar places for keeping in or shutting out the cold, the main point in practice is to prevent altogether the entrance and exit of air.

These simple general principles, well known, yet most important at this season of the year, deserve specially the attention of those engaged in the manufacture and preservation of ice.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

CORROSION.

AT the last ordinary monthly meeting of the executive committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, January 28, 1862, William Fairbairn, Esq., C.E., F.R.S., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month the ordinary visits of inspection have been made, and the following defects discovered in the boilers examined:—Fracture 3 (1 dangerous); corrosion, 17 (2 dangerous); safety-valves out of order, 5 (1 dangerous); water gauges ditto, 12 (1 dangerous); pressure gauges ditto, 13; feed apparatus ditto, 5 (1 dangerous); blow-off cocks ditto, 22 (1 dangerous); fusible plugs ditto, 7; furnaces out of shape, 6 (1 dangerous); Total 90 (8 dangerous). Boilers without glass water gauges, 2; without pressure gauges, 1; without blow-off cocks, 6; without feed back-pressure valves, 16.

"From the nature of the defects discovered during the last month, I would wish to take this opportunity of calling the attention of the members to the subject of Corrosion, which is often stealthily eating away the strength of boilers entirely unsuspected; and I wish especially to put our members on their guard at this point, because I find that frequently when a boiler is discovered to be in a corroded state, even though it may have arrived at an advanced stage, and be on the point of rupture, still the discovery proves quite a matter of surprise to the owner, who expresses astonishment that *his* boiler should have been so affected. The fact is, however, that no boiler allowed to pass a whole year without being examined 'Thoroughly' (*i.e.*, both inside and outside), so that the condition of all the plates may be ascertained on both their surfaces, can be pronounced as free from corrosion, or worked without risk—more in some cases, of course, than in others—in illustration of which I may state the following:—

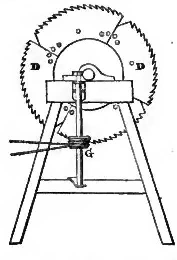
"An ordinary internally fired boiler had been thoroughly overhauled, re-seated, and left in good repair two years ago, the association not being afforded the opportunity of making the regular annual 'Thorough' Examinations during that time. This boiler was set on a mid-feather, and on being scaled a few days since, a hammer was sent through the plate at the bottom, which, on examination, proved to have been so eaten away as to have become at that part as thin as a sheet of paper. On going up the flues, I found that the plates were affected not at one place only, but throughout the whole length bearing on the mid-feather, and on removing some of the bricks, the plate was seen to be quite crumbling away, and at least a quarter of a pint of oxide was readily collected from a small surface only. In one or two places, where there had been small leaks at the ring seams (which so commonly happen when the feed without being previously heated enters the boiler immediately at the bottom), the mid-feather had ponded the water and held it in contact with the plates, in which it had cut complete channels, as well as eaten away surfaces of considerable area, while internally the plates were quite 'hogged' in places over the mid-feather, and the boiler was evidently in a most unsafe condition, so that a thorough repair (now in progress) was necessary. The danger of setting boilers on mid-feathers has for years past been pointed out by this association, and the practice, I trust, will soon be entirely discarded. Explosions caused by mid-feathers are likely to be of the most destructive character, since the rent would not confine itself to a single plate, but extend throughout the whole of the weakened part, and nothing 'skies' a boiler more effectually than a longitudinal rent at the bottom.

"I should add that it is by no means intended that the service rendered by this association should diminish the exertions of the steam users' *own* engine attendants; but, on the contrary, that it should stimulate them to greater care. Thus the fact of our inspectors getting inside each boiler annually, as well as going up the flues to make 'Thorough' examinations, should by no means stand in the place of this being done by the owners' own engineers at least twice a year in addition. To leave the detection of corrosion to the sweeps who clean the flues, although sometimes allowed to be the case, is, I think, what no engineer would do, either having his master's interest at heart, or regarding his own safety, as he should.

"Three explosions have occurred during the last month to boilers not under the inspection of this association, each of which has been attended with fatal consequences; in one case as many as four men being killed, and several others wounded. One of these explosions happened to the boiler of a portable agricultural engine; another to a bath or kitchen boiler, in which the taps in the inlet and outlet pipes were both foolishly closed at the same time, so that, there being no safety valve, the pressure was bottled up, as in the case of the Great Eastern water heater, and explosion became inevitable. A third explosion occurred to a colliery boiler, of plain cylindrical egg-ended construction, 40 feet in length, 5 feet 3 inches in diameter, the plates being three-eighths of an inch in thickness, and the working pressure 30lbs. per square inch. The boiler was fitted with two sufficient safety valves, and two floats, one of which had a low water alarm whistle; the explosion was occasioned by the plates over the furnace becoming over-heated (although there was no evidence of deficiency of water), the boiler being rent in four pieces, each of which was blown a considerable distance. The cause of the overheating was attributed to the *sedimentary character of the water*, and I call the attention of our members to this fact as another illustration of what has been previously stated, that 'incrustation should not be regarded merely as a matter of inconvenience, but frequently of positive danger.' There are other points of interest connected with this explosion, the consideration of which space compels me to defer to another opportunity."

The *New York World* publishes a list of 131 lighthouses destroyed and light-ships removed by the rebels since the war began, furnished by E. and G. W. Blunt, the well-known nautical publishers.

SEGMENTAL CIRCULAR SAWS.



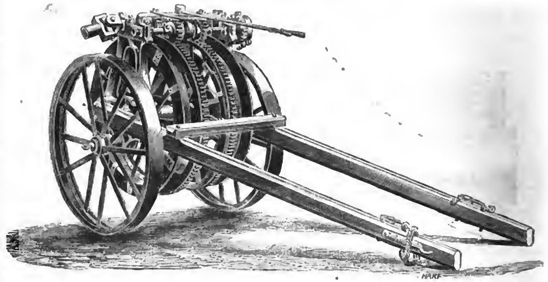
THE annexed figure represents a circular saw, composed of segments of steel plates, *D D*, secured to a backing plate and central flange by screw bolts. The segments are cut and manipulated to fit together, then they are secured as represented, forming a built circular saw. A saw made of a single plate, when it becomes heated in sawing hard wood, is liable to buckle, but a saw made of segments, it is said, will expand, when heated, without buckling. Very large circular saws can be constructed in the manner represented out of plates of moderate size. Patented by R. K. Hawley, U. S.

PROGRESS OF TELEGRAPHY.

ON Saturday last, a meeting of the friends and associates of Sir Charles Bright, was held at the George Hotel, Dale-street, Liverpool, for the purpose of presenting a testimonial to him on the occasion of his relinquishing his position of Engineer-in-Chief to the British and Irish Magnetic Telegraph Company. The testimonial consisted of a handsome silver candelabrum, manufactured by Mayer, and valued at 140 guineas. The testimonial was thus inscribed:—"Presented to Sir Charles Tilston Bright, by some of his friends and associates, in recognition of his great services in the development and extension of Telegraphic communication, January 25, 1862."

The testimonial having been then formally presented, Sir Charles, after acknowledging the kindness with which his friends had chosen to remember his long connexion with them, said:—The Chairman has alluded to the length of my connexion with the company with which I have ceased in an active point of view to be associated, though as their consulting engineer, I shall still take the liveliest interest in their welfare, and it may be interesting in considering the subject from the view of telegraph progress to remember that at the time he and I first became connected with this undertaking—some ten years ago—the number of miles worked by the company was something under forty, while the present mileage is upwards of 4,000. The staff employed at that time did not exceed, or much exceed, a score in number, while probably 1,500 would be not far off the present number. At that time there was only one telegraph in existence in this country, and, whilst the charge for a message from London to Liverpool was 8s. 6d., the messages were frequently re-transmitted at Rugby and Birmingham. At the present time we have in Great Britain and Ireland something like 15,000 miles of line, and the annual receipts for telegraphic messages may possibly surprise some even of you, who may not have thought of the amount of the traffic. The total amount received in this country for telegraph messages at the present time is something as nearly as possible about £350,000 a year, a very large amount to be taken in such small sums. The extension of the land system throughout the world has been equally rapid during the same period. There is now, in addition to the 15,000 miles of line in Great Britain, some 48,000 miles of line in America, some 80,000 miles in Europe, and a smaller, but very rapidly increasing mileage in Australia; the total amount of land lines of telegraph in the world being not far off, at the present moment, 150,000 miles. That has been the growth of a very few years. Looking forward to the future (a subject which must be interesting to all of us who are actively engaging ourselves in the extension of telegraphic communication), although, we were unfortunate in the first Atlantic enterprise,—a line, the carrying out of which from its very nature could not be dictated by experience—yet looking forward to the extension of a line across the Atlantic, we have now the certainty that, in a very short period, all difficulties will be overcome, and we shall have a line working direct from Ireland to Newfoundland again upon a permanent basis. Not only is that undertaking being actively pushed forward at the present moment, but careful surveys have been made for the northern *route* by Iceland, Greenland, and Labrador, the result of which, in my opinion, very greatly warrants the projectors of that line in going forward with a view of shortening the circuits to be worked, and so reducing the risks and costs of such a line. Again, in the South Atlantic active endeavours are being made—in fact the Spanish Government are initiating the arrangements for a line to be carried from Cadiz o the Canaries, thence to the Cape de Verd Islands, and from there to the Island of St. Paul, in the South Atlantic Ocean. There is only one stretch of 800 miles from St. Paul to the Island of San Fernando-de-Noronha, and thence to the Brazilian coast, is a comparatively short distance. From the Brazilian coast the line will pass along the shores of British and French Guiana to Trinidad, and thence by the train of West India islands to the Spanish possessions of Porto Rico and Cuba. From Cuba a line will be carried to Jamaica and Florida, with another branch to Panama. Going south from the Brazilian coast, a branch line will extend to Rio and Buenos Ayres. On the opposite side, looking towards the east, we are actively engaged in prosecuting a substantial line to India. The line made by Government from Malta to Alexandria continues in excellent working order, and its receipts so far encouraging—which, looking at the progress of these undertakings in a commercial point of view, interests all of us very greatly—the receipts upon the Government line of submarine cable from Malta to Alexandria, which opened in October with returns of £200 per week, have steadily increased until, at the present time, the weekly income is little less than £600 per week. This is a most important thing, when we consider that the electrical communication is at present stopped towards the east at Alexandria, and that no return messages have yet been received from Australia, China, or India. But we are also busily engaged in pushing forward a line in continuation of the Alexandrian line, and we hope within six weeks from this time to have opened a station at the island of Jubal, at the mouth of the Gulf of Suez, where the Peninsular and Oriental Company's steamers will call, by an arrangement made with the Post office, to receive and carry on telegraphic messages to India. We have also a vessel recently equipped and sent out from this country, with 200 miles of cable, to repair the eastern section of the original line, which failed soon after it was laid between Aden and Kurrachee. Throughout India the telegraph has been extended with scarcely any limit—as, indeed, there is hardly any limit to the construction of any land line. From Kurrachee the circuit is complete to Rangoon. From Rangoon the line will eventually be carried by Singapore and Batavia to Australia. On the other side a line will be taken to Japan; thence to Kamschatka, where the Russians are pushing their lines eastwards and onwards by the small chain of the Aleutian Islands to the western coast of the continent of North America. Thence it is an easy step along the coast to Vancouver's Island, which is already connected by telegraph with San Francisco. From San Francisco there is the most extrordinary line of land telegraph ever constructed in the world, which passes *viâ* Sacremento by the Salt Lake City to Fort Kearney, and thence to St. Louis through an entirely uninhabited country, and by means of which the merchant in New York can now communicate directly with San Francisco. Another line will also be carried entirely on British ground through the punchbowl pass of the Rocky Mountains to British Canada. And thus when these different enterprises, in some of which I am concerned, are accomplished, we shall not have a girdle round the earth, but two girdles completely round the world. I have alluded, gentlemen, thus to what is taking place at present in the extension of telegraphic enterprises, because it is one which very much effects all of us. The telegraph, as we know, had its rise altogether in this country. The first telegraph invented by Cooke and Wheatstone, in 1835, was the forerunner of all telegraphs of all countries. Whether it be Professor Morse's telegraph of 1843, or others at later period, the type of all the instruments has been taken from the inventions at an earlier date in the country. The first submarine telegraph was laid from this country, and all the different cables have been sent out from this country. We may therefore look upon ourselves to some extent as being the nursery of telegraphs for the world, and it is therefore a matter of great consequence to us all to know what is going on, not merely in the more vulgar pecuniary light, but in the development of an invention of the highest importance to the human family, to which we are devoted, and bound by ties of attachment which most of us have felt in the exciting moment of connecting up for the first time distant countries or provinces whose inhabitants are separated, so far as their bodies are concerned, by hours or days of travelling.

MR. J. FOWLER'S NEW WINDLASS FOR STEAM CULTIVATION.



MR. J. FOWLER'S NEW WINDLASS FOR STEAM CULTIVATION.

Cultivation by steam has at length become one of the great facts of the age, and we are mainly indebted to Mr. J. Fowler for the practical demonstration of that fact. Mr. Fowler has laboured long and hard, and has exhibited a rare energy, to prove that a plough, or cultivator, can be more effectively drawn over the land, and can go deeper into the land by steam-power than by horse-power, and that the results derived from its application are much more beneficial and profitable than is commonly believed.

The windlass to which we now call the reader's attention forms part of Mr. Fowler's apparatus for steam cultivation, and may justly be termed the last invention of that class of machinery. Our wood-cut gives a very fair representation of the machine. The great object of Mr. Fowler in the adjustment of his windlass, has evidently been to economise power, or, in other words, to transmit the power of the engine to the cultivation of the land with the least possible loss. Hitherto all winding windlasses used for this purpose lose a great proportion of their power, either by reason of the slack-rope trailing on the land between the porters, or by the application of breaks to check the speed of the outpaying drum. It has been stated by an eminently practical engineer (and with whose statement we quite agree), that he has found when the breaks of his windlass are applied sufficiently tight to carry the outpaying rope off the land, that this loss alone amounted sometimes to one quarter of his engine-power. The advantages, therefore, of the patent break, by which the power required to carry the slack, or outpaying rope, is made available to draw the hauling drum. The windlass is mounted on a compact two wheel carriage, the shafts of which being lowered into the ground, against suitable abutments, form a resistance to the pull of the windlass. The drums revolve on horizontal axles; and directly over the drums are placed the driving and break shafts, which have their bearings on the side framing, the driving shaft being coupled to the crank shaft of the engine by a union joint. On each of these shafts are two loose pinions, of equal size, each being alternately connected to its shaft, by clutches acted upon by the reversing levers, which cause the drums when connected by the break, to revolve in opposite directions. On one end of both these shafts outside the bearings, are carried two unequal sized pinions, which are geared together, the smallest being regulated into the driving shaft, the other running loose on the break shaft; and to this loose pinion the break is attached, the break strap being connected to its shaft. It should also be observed that the difference of size in the break pinions is rather more than that of the drums when full or empty of rope. The action is as follows:—the driving shaft is always acting on the hauling drum, and as the outpaying drum does not by reason of the difference in the size of the break gear, pay out fast enough, the hauling drum has to pull the rope off, and in so doing causes the break to surge in the direction of the driving shaft, so that whatever amount of power is required to keep the outpaying rope taut is transmitted through the break, back to the driving shaft.

This form of break, however, belongs to what is called the stationary windlass system of steam cultivation, and notwithstanding the advantages it gives, that system still retains many of its old defects. This break will not bear a comparison, in its working results, with the same power of engine applied on Mr. Fowler's plan of direct action, in which two centres only are employed, and those for sheaves of larger diameter. Whereas in the stationary system, there are five or six centres, through which the power is constantly passing, and as constantly being absorbed by the friction of those centres. This windlass, taken altogether, is certainly the most complete machine of its kind that has been as yet produced.

BLACKBURN'S RAILWAY AXLEBOXES.

Fig. 1.

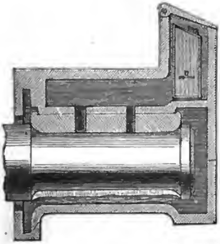


Fig. 2.

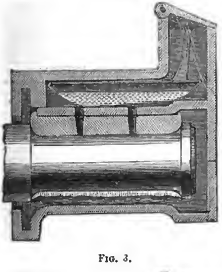
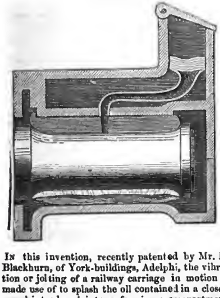


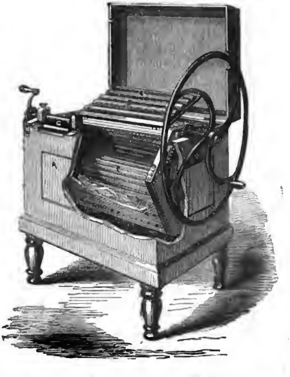
Fig. 3.



In this invention, recently patented by Mr. B. Blackburn, of York-buildings, Adelphi, the vibration or jolting of a railway carriage in motion is made use of to splash the oil contained in a closed vessel introduced into or forming a compartment of the axle box up to an aperture in the upper part of the vessel or compartment, through which the oil flows out of the vessel, and runs down to the journal beneath. A vibrating spring paddle is sometimes applied near the bottom of deep vessels to assist in splashing the oil up from the bottom to the aperture in the upper part of the vessel.

Fig. 1 of the above engravings shows a section of an axle box of the ordinary construction, having a deep vessel introduced into it to contain the oil. In the upper part of the vessel is an aperture up which the oil is splashed up by the motion of the carriage, and runs down to the journal beneath. It is preferred to fit this aperture with a capillary wick, which imbibes the oil splashed up to it. A vibrating spring paddle is placed in the vessel to assist in splashing up the oil. A rod keeps the oil vessel in its place, a spring being placed under it to keep it steady. Fig. 2 is a similar section of the same axle box, having a long shallow vessel introduced into it to contain the oil. When it is necessary, in order to pass this long vessel into the axle box, it is made of leather or other flexible materials. The aperture for the exit of the oil is at the upper part of the vessel. In Fig. 3 the oil vessel is furnished with a pipe fitted closely into a hole, at the bottom of the ordinary grease compartment. This pipe is trumpet-mouth shaped, on which a pad of capillary material rests. This pad fills up all that part of the compartment which is about the trumpet mouth. The oil being introduced into the compartment is splashed up by the motion of the carriage to the capillary pad, whence the oil drips down through the pipe to the journal below.

A NEW WASHING MACHINE.



The accompanying engraving illustrates a simple, strong, and durable washing machine. It is represented open to show the interior, and it consists of an outer box, *A*, resembling a common family refrigerator. It is lined inside with zinc, and is water-tight. *B* represents a hexagonal hollow box, perforated with holes and fluted inside, as shown by its lid, *D*. This box holds the clothes, it is hung on journals, has a loose fluted roller, *C*, rolling with the clothes inside, and it is rotated by the crank handle of the fly-wheel through the gear wheels, *E F*, so as to dash among the suds that are placed in the outer box. *G* is a clothes wringer composed of two accommodating pressure rollers covered with india-rubber. When the clothes are washed in the hollow hexagonal box, *B*, they are placed, piece after piece, between these rollers, and by turning the handle, the clothes carried through, the water pressed out of them, and they drop into a basket situated underneath.

A certain quantity of hot suds is poured into the outer box, then some of the batch of clothes to be washed are placed in the box, *B*; then the loose fluted roller, *C*, is put in, and afterward the rest of the clothes, leaving the roller in the middle of them. The lid of the hexagonal box is then shut down and fastened with a bolt, and also the lid of the outer box, which has a deep rim upon it. The box inside is then rotated by the fly-wheel handle for about from fifteen to twenty minutes, which is about a sufficient length of time for washing a batch of coloured clothes requiring only one course of suds. The form of the box makes the clothes roll over and drop down from one side to another, as it rotates, similar in its action to the old dash wheel, while the roller exerts a gentle padding action, squeezing the dirt through the perforations of the box. The patentee is H. E. Smith, 111 East Houston-street, New York.

The speech of the Emperor of France, delivered on Monday last, in the French chambers, and which occupied a column and a quarter of the morning papers, was transmitted through M. Reuter's office by the Submarine Telegraph Company to London in thirty minutes.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

Jan. 28th.—John Hawkshaw, Esq., President, in the chair.

The Paper read was "On the Form and Materials for Iron Plated Ships, and the Points requiring attention in their Construction," by Mr. Joseph D' A. Samuda.

The Author stated that, Iron-Plated Ships having now become a necessity, it was important to ascertain, first, the best description of construction of ship and armour, and secondly, the best form and dimensions of vessel.

To effect these objects, there were four indispensable conditions; first, these vessels must be of such dimensions and power, and be built on such lines, that they should always command a superiority in speed, over the best timber-built frigates afloat; secondly, they must be protected with armour over their entire length; thirdly, the armour must be so applied as to be capable of rapid replacement, or repair; and fourthly, the armour should enter into the construction of the ship, and thus give strength to the whole fabric, as well as protect it from an enemy's fire.

These conditions had only been partially attained in the vessels already constructed, or proposed to be constructed; for, the Warrior class obtained speed alone, the Defence class failed in all, Valiant class only approached the second condition, and the three new ships of 6,700 tons burthen, recently contracted for, at a cost, with their engines, of £400,000 each, would probably possess the first and second, but not the third and fourth conditions.

Although the Warrior was highly creditable as a first effort, and was not defective in strength, yet it was a complicated and costly construction, and its character should not, therefore, become stereotyped, as incapable of further improvement, or as if it were not desirable to seek for it.

The author proposed, that the framework of the hull should be built as in an ordinary first-class steamer of the same size; and that outside the framework, and rivetted to it, there should be five longitudinal ribs, at intervals of 5 feet, reaching 20 feet below the gunwale. These longitudinal ribs should be of of bars of rolled iron, 2½ inches in thickness, and 16 inches wide, the outer 4 inches on each side being recessed 1 inch. The ordinary skin plates, 1 inch thick, were then rivetted in these recesses, so as to form a flat surface for the reception of the armour, each strake of which was to be made to correspond with the distance, from centre to centre, of the longitudinal ribs. The edges of the armour plates, 5 inches in thickness, were then to be bolted, or rivetted through the ribs longitudinally, the vertical butt joints of each plate, made to break joint with the skin plates, being rivetted to corresponding ribs 2½ inches in thickness, placed between the longitudinal ribs, and attached to them with fish plates. It had been determined by experiment that this thickness of rib would be sufficient to render the edges of the armour plates, when weakened by the rivet holes, equal in strength to the central body of the plates. By this arrangement, a perfect ship, without armour, was first made; then a complete armour case was attached through the longitudinal ribs, without interfering with the joints, or fastenings of the ordinary skin of the vessel. Indeed, the skin would be so distinct from the armour that, in time of peace, the armour could be removed, and the vessel be used as a transport, if desired. By these means the armour could be rapidly repaired at any point, and there would be no necessity for tongueing and grooving the plates, adopted as an expedient by the Admiralty to remedy the bending up at the edges, which the present imperfect mode of fastening rendered them liable to.

Thus, protection would be obtained over the entire length of the vessel, by the armour admitting of rapid replacement, and entering into the construction of the ship. It remained only to show what dimensions and power were necessary to secure speed. For a 32-gun frigate, constructed as described, the best dimensions would be 382 feet long, 55 feet beam, and 31½ deep to the main deck; 5,600 tons burthen, and fitted with engines of 1,200 H.P., by which a speed of 15 knots an hour could be obtained, with the armament, ammunition, and coal on board, and with the port sills 9 feet above the water line. Such a vessel would have even greater speed than the Warrior, and be wholly protected over the entire length of the sides.

As the importance of complete protection had now been recognised by the Admiralty, it was desirable to compare this armour-skin vessel, of 5,600 tons burthen, with those now building. The Admiralty vessels were to be 6,700 tons burthen, and 1,250 H.P., but they would not be able to carry a heavier armament, or possess a higher speed than the proposed vessel; they would be less manageable, form larger objects to fire at, and cost £400,000 each instead of £340,000, or in a fleet of twenty-four such frigates, one million and a half pounds sterling more.

For coast defences vessels might be built, protected from stem to stern, having a length of 200 feet, beam of 48½ feet, depth of 25 feet, burthen of 2,200 tons, and engines of 350 H.P., pierced for thirty-two 68-pounder guns but carrying only sixteen, with a draft of water of 16 feet, when the guns, ammunition, and coal, were on board, and capable of attaining a speed of 11 knots an hour.

In conclusion, the author thought that the time had arrived, when the Admiralty should see the propriety and the advantage to the public service, of abandoning the monoply of restricting all advance in the construction of mail-clad vessels to plans and systems emanating from themselves; and that it would be far better to trust to the engineering skill of this country, leaving it free to take the initiative in improving this branch of National Defence, and the Admiralty only exercising a veto within such limits as experience fitted them to form a judgment upon.

It was announced that the discussion upon Mr. Samuda's paper "On Iron-Plated Ships," which was commenced, would be resumed at the next meeting, Tuesday, February 4th, when the monthly ballot for members would take place.

MEETINGS FOR THE WEEK.

Mon.—*Soc. of Engineers*, "On Horse Railways," by C. L. Light, Esq., at 7 p.m.
United Service Inst., "An Account of a Lead-covered Carrack of the Middle Ages," by Lieut. A. Windus, H.M. Indian Navy, at 8.30 p.m.
London Inst., "On Arts, Manners, and Customs of Japan," by D. Macgowan, M.D., at 7. p.m.
Tues.—*Inst. Civil Engineers*, Renewed Discussion "On Iron-plated Ships," at 8 p.m.
Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., F.R.S., at 3 p.m.
Wed.—*Society of Arts*, "On the Improvement and Progress in Dyeing and Calico-printing since 1851," by Dr. F. Crace Calvert, at 8 p.m.
London Inst., "On the Geological and Geographical Distribution of Organized Beings," by E. W. Brayley, Esq., at 7 p.m.
Geological Soc., I. "On Isodiametric Lines, with special reference to the Carboniferous Rocks of Great Britain," by E. Hull, Esq., F.G.S. II. "On the Recent Eruption of Vesuvius," by M. P. de Tchihatcheff, communicated by Sir R. I. Murchison. III. "On some Volcanic Phenomena observed at Torre del Greco," by Signor L. Palmieri, at 8 p.m.
Thur.—*Royal Inst.*, "On Heat," by John Tyndall, Esq., at 3 p.m.
Antiquaries, at 8.30 p.m.
Royal Soc., at 8.30 p.m.
Linnean at 8.30 p.m.
Fri.—*United Service Inst.*, "The German campaigns of Gustavus Adolphus," by B. C. Hooke, Esq., at 3 p.m.
Royal Inst., "On Fossil Remains of Man," by Prof. T. H. Huxley, at 9 p.m.
Sat.—*Royal Inst.*, "On the English Language," by Rev. A. J. D. D'Orsey, B.D., at 3 p.m.

TO CORRESPONDENTS.

Received,—G. W., Com. S., E. G. D., W. D. M. M., P. and T. S., E. J. R., R. C., J. B. (The Safety Respirator requires a drawing) J. H., Admiral T., G. S. C. D., Anti-typhoid, W. J. I., R. J., S. S.

THE NEW HARTLEY COLLIERY ACCIDENT.

We beg to acknowledge the receipt of the following sums on behalf of the widows and orphans, occasioned by the New Hartley catastrophe :—

R. A. B.	£1	0	0
J. P. E.	1	0	0
E. G. D.	1	0	0
Collected at P. and F. Schaffer's factory, 6, Golden Square, London	3	0	0

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

PREVENTION OF BOILER EXPLOSIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—The common safety valve applied to the boilers of engines, though useful is not infallible, and is always secure or dangerous at the will of the attendant, who, by overloading it, renders it the strongest instead of the weakest part of the boiler. I would recommend when high-pressure boilers are used to attach (when *proved* up to a certain point) an "inverted syphon" of proper dimensions, containing such a column of "*quicksilver*," as is required to confine the steam within certain limits, but which suffers it to blow off when it attains such power as might endanger the boiler.

I am well aware that high-pressure engines are perilous—condensing engines are so sometimes—the *mercurial-valve* ensures the safety of both. It should be put out of the attendant's reach. The efficacy of the above simple expedient would secure all steam engines, steam vessels, &c., from the danger of explosion. I remain, Sir, yours faithfully,

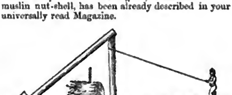
James Bruce.

28th January, 1862.

◆

TO BLAST AND SPLIT STUMPS WITH PERCUSSION CARTRIDGES.

Sir,—As my plan of splitting stumps and other large timber by means of my percussion cartridges, is now very extensively used in Ireland, for the purpose of procuring fuel for the poor—I enclose a diagram of the *modus operandi*, which I shall feel much obliged if you will be so kind as to have copied into your Magazine, as a correct knowledge of the operation will be useful all over the world. The *phlogistic pill*, composed of heads of Bell's lucifer matches, mixed with small pieces of broken glass, and enclosed in a muslin nut-shell, has been already described in your universally read Magazine.



Bore a hole with an inch auger more than half way down into the most unwedgable part of the stump then insert the cartridge, and ram it home to the bottom by means of the round iron bar; draw out the bar which is of the same diameter as the auger that bores the hole; then drop in the phlogistic pill, insert the round iron bar to within three or four inches of the pill. It may be supported in this position by a piece of small wire passing traversely through the bar, and resting on the surface of the stump. A heavy plank of wood, having a short tranverse plank on its outer end to keep it steady, is raised about three or four feet above the projecting head of the iron bar, and supported in that position by a stout pillar of wood; a long cord is tied to the upper part of the pillar, and, when all is ready, by pulling away the pillar the plank falls on the bar, exploding the cartridge and rending the stump in many pieces. The iron bar may be attached to the pillar with a short strong cord, so as to find it easily on the broken ground. The iron may have a recess cut in its lower end to hold the phlogistic pill, so that the pill may be withdrawn if it should not be expedient to fire the charge at the time appointed. The explosive power of the cartridge is more efficient when fired in this manner than when fired by a fuze and tamping, because the fuse method is slower in igniting the *whole* of the powder.

Yours truly, J. Norton.

◆

THE MECHANICAL CAUSE OF THUNDER.

Sir,—If, as I believe to be the case, the commonly assigned cause of thunder is not the origin of this pheunomenon, you will, I think, allow me to point out in the Mechanics' Magazine that which really produces it.

It is stated, perhaps, in every scientific work, that thunder is occasioned by the concussion or re-uniting of the atmosphere, after it has been separated by the electric fluid, which explanation is generally, I suppose, at first sight, looked upon as the correct one; but it is not so, and this inasmuch as the entrance of the atmosphere into a vacuum, does not occasion a sound similar to that in question, and it cannot be supposed that the filling up of a very large vacuum, as that produced by the electric fluid, by a very elastic substance, as the atmosphere, gives rise to it, seeing that a very loud noise is dependent upon the great resistance of the substances occasioning it. It must, therefore, be allowed that the sound known as thunder is caused by the *separation* of the atmosphere by the electric fluid, and that the excessive rapidity of the separating force counteracts what would otherwise be the neutralizing effect of the air's elasticity. Similarly, the smack of a whip is not effected by the coming together of the atmosphere, but by its rapid separation, inasmuch as otherwise a less quick stroke or a wave of the hand would occasion a considerable sound. It thus appears why the curling of a whip is necessary to the production of a smack, the curve being effected with great rapidity. I have found that Mr. Samuel Bailey has ("Discourses on various subjects," London, 1852) made a few observations upon this subject, in which he attributed the noise of thunder conjointly to the separation of portions of the atmosphere, and their collision, supposing that the sounds arising from these effects are combined upon reaching the ears; if, however, it were true that any part of the sound of thunder is produced by this collision, it would not be true that the sound arising from it would fall upon the ears at an imperceptible interval of time from that at which the other sound would reach them, and this, inasmuch, as the reunion of the atmosphere occurs at an appreciable time after its separation. I am, Sir,

Yours faithfully, J. Alexander Davies.

January 28, 1862.

◆

THE APPLICATION OF DIRECT ROTATION TO LOCOMOTIVE ENGINES.

Sir,—I am not able to find any reason why the engines constructed for locomotive purposes should not be rotary, and would therefore make this suggestion. The shortness of an engine's stroke consequent upon the use of a crank is more than rendered of no advantage by virtue of the loss of power which this appliance occasions, while the application of a direct rotary motion, although the stroke would be longer, would be superior, inasmuch as the loss in question would be got rid of. I apprehend that the contrivance brought forward under Mr. Hudson's name (Mechanics' Magazine No. 159), would be suitable for the application mentioned; and am Sir,

Yours faithfully, Alexander Davies.

January 28th, 1862.

P.S. In using the word "stroke" in connection with rotary engines, I, of course, mean the half circle of rotation, which corresponds to the "stroke" of a crank engine.

◆

ENGINEERING ENTERPRISE IN AUSTRALIA.

Sydney, New South Wales, Nov. 22, 1861.

Sir,—I think that it will be interesting to those of your readers who are of an inventive turn of mind to be informed of the great economical and mechanical problem that is now waiting solution in this colony. I cannot hope that I shall convey to them an idea of the mportance which is attached to the solution of this problem here, but it may be sufficient to assert generally that all classes agree that the prosperity, if not the solvency of this community depend upon it. I allude to the improvement of our means of internal communication. I have resided here now about ten years, and have occupied during the whole of that time a rather prominent public position, and have taken note of public affairs during that time, and I do not hesitate to say that any man who should devise a plan for opening up the roads of this colony at a cost within the means of the population would secure himself a large fortune, would benefit incalculably, what might be, one of the most thriving colonies of Great Britain, and would establish among its inhabitants an imperishable name.

You are aware, for you have published the fact, that we are trying to construct railroads. I will shortly tell you the history of this attempt. We have been eleven years at work, we have spent two and a-half millions of money, for which we have to pay an annual interest at 5 per cent. For this sum we have constructed about 55 miles of locomotive railway, and the result is that the total returns from all the lines average about 1 per cent. on our outlay, leaving us the difference of 4 per cent. to pay out of the revenue of the country, in addition to all the working expenses, for you must know that our railways are all government works. It is now gravely proposed to expend about £4,000,000 more in these works, of course, adding so much to our national debt, and seeing that the whole population of the country, according to the last census, does not equal the population of the town of Birmingham, this becomes a very serious matter for each member of that population. Incredible mistakes have been made in our railways. The line from Sydney to Parramatta cost £40,000 per mile, although the land was given by the Government. Under these circumstances (for a full account of which I refer to a full report of the debate on the subject in the Legislative Assembly, printed in the *Sydney Morning Herald* of October 31, 1861, and following days), thoughtful men are casting about for some means of communication that will meet our necessities, and not involve the country in such a heavy amount of debt. We accept the warning of America and Canada (and I fear I must add our neighbour Victoria, where the Government has been frightfully lavish in their expenditure), and are ready to appeal to the engineers and inventors of England for the construction of a locomotive engine adapted to convey heavy loads at an average speed of three miles per hour over the *main roads of this country*. This may appear to you a light thing, seeing that locomotive steam carriages have run on the highroads of England years ago, but I assure you it is more difficult than it appears, and if such a machine could be constructed that would answer here, the proprietor would reap an enormous fortune.

To give you some idea of the amount expended in carriage, I will take only one of our main roads—the Western to Bathurst. It is mountainous, but 100 tons of goods are conveyed to and through that town daily. It is only 113 miles from Sydney, and the average charge is £10 per ton for the journey, or £365,000 per year carriage on that road alone. The drays are frequently two months doing the 113 miles, sometimes three months, but the average is *one month*.

Now the effect of this state of things (which prevails on the northern and southern roads in an equal degree) is that business here is utterly stagnant, and the colony is in an alarmingly depressed condition.

Now, Sir, I ask you whether any of the recently invented ploughing machines are adapted to our purpose? Has Tuxford's patent traction engine proved a failure? Has any method of progression over the surface of the earth analogous to feet been invented in machinery which would prevent the cutting action of wheels on the surface of the road? which is the source of all our trouble, and has cost us such immense sums in the repair of our roads. In fact, with an enormous annual expenditure, we have not a single mile of good macadamized road in the country districts.

I assure you, Sir, we are at our wit's end. We have had competent engineers here who have all failed. The last was Captain Ben Hay Martindale, C.E., of the Royal Engineers, and Mr. W. C. Bennett, C.E., both of whom, though highly qualified men, gave up the task in despair. We have now Mr. John Whitton, sometime railway engineer on the first English lines. He, too, is an excellent officer, but fails to satisfy the ignorant and unreasonable expectations of the colonists. We know without money we cannot have first class railroads, and we are yet too small a community to afford them.

The question is, then, What are we to do? I appeal to you to set the thoughts of inventors at home at work, and I sincerely hope that their efforts may be crowned with success. I venture to forward you a letter, which I addressed to the leading paper here on the subject. I still think it a valuable suggestion, although it was not carried out by the Government here, because they, in common with the great majority of the inhabitants, believed that the task I had proposed for the inventive faculties of English engineers, was far beyond their ability, and, in fact, an *impossible one!*

I am sure, Sir, that you will not concur in that view, for the word "impossible" in engineering matters has almost been banished from the dictionary, and I trust at all events you will shortly direct the attention of ingenious men at home to the field there is for their talents in their country.

If you should be obliging enough to answer this, I should be very glad to be informed whether Palmer's Patent Railway (Suspension Railway), described in "Herbert's Engineer's and Mechanic's Cyclopædia," Vol. 2, page 427, has ever worked, and if so where, and what was the result. I have suffered very much ridicule here for suggesting this mode of carriage, but I cannot see the absurdity of it. I notice that Tredgold speaks highly of it, and that it was in use at Ware, in Hertfordshire. Can any of your readers give me any particulars of its cost and of its performances? Was it ever repudiated by Mr. J. H. Palmer, the inventor? An impudent person here, of the name of Brees, who assumes to be the author of a book entitled "Railway Practice," says that he knew Palmer well, and he was heartily ashamed of having invented this system of railway, which he patented, and Tredgold approved. I cannot believe it. Hoping to be favoured with some reply,

I remain, Sir, your obedient servant,

Joseph Dyer.

Gossip.

There are differences of opinion as to the propriety of such vessels as the Resistance and the Defence being provided with *iron* bowsprits. Nautical men have pronounced against the use of such bowsprits for such vessels. It is intended to abandon the "telescopic" bowsprit of the Resistance. That vessel will be fitted with an iron bowsprit, weighing nearly five tons weight.

Though the Commissioners of Customs have been instructed to permit the free exportation of fire-arms, there is but little hope that a similar briskness of trade which prevailed at Birmingham, previous to the proclamation of the 30th of November, 1861 will be resumed. Cut off from importing fire-arms, the Americans of the northern states commenced in earnest to supply their own wants. The government arsenal at Springfield has been largely increased, and it is now capable of producing 10,000 rifles per month. There have recently been three or four private firms started for the manufacture of rifles, &c. One of those firms, the Union fire-arms company of New York, has undertaken to execute contracts for the production of 90,000 stand of arms, including 25,000 of Marsh's breech-loading and muzzle loading rifles, and 65,000 Springfield rifle muskets.

Admiral Sartorius has the courage to vindicate the "Stone fleet." In a letter to the *Daily News* he says:—"If a whole army could be destroyed by a blow, war would be rare indeed. The greatest calamity that could occur to a country is to be overrun by an invading army. In the presence of only four or five of the class of vessels alluded to, an invasion of our shores is literally impossible. To embark an army sufficiently strong to warrant any slight hope of success would require numerous vessels for its embarcation, these laden with troops and munitions of war could not move quickly and stealthily, and when out at sea nothing could prevent half-a-dozen powerful, handy, and rapid "Rams" getting in amongst them, and sending to the bottom, not a thousand, but thousands, if they did not surrender or disperse. In fact, no invasion could possibly be attempted, if it were known that the Steam Rams were on the watch. Should the invading army be accompanied by a similar class of vessels, ours would naturally, for the time, avoid the encounter with their own class to get amongst the transports, and so destroy the army embarked. It must be evident, therefore, that this power of sinking a ship and men at once by the blow need not be used, except the enemy courted the risk. Unhappily, since man took to slaying man, to destroy the greatest number of your enemies, and to weaken their means of offence with the greatest economy of life and property on your own side, has been a principle never deviated from in war, ancient or modern. This principle may be quoted to justify the use of the "Stone Fleet." Well, I am not disposed to deny it. If a really effective blockade is necessary and justifiable, it is the same thing whether effected with vessels above water or under water. In the first case, however, it is attended with much more risk to the blockaders. Long wintry nights, heavy gales, lights and buoys removed by the opposite side (this is bad for innocent neutrals also), entail a strong probability as to the loss of some one or more of the blockading squadron, but the ships at the bottom effect the purpose quietly; and when both parties are agreed, with the vast means we possess in the present day of working under water, ships, stones, and mud, would be cleared away in less than six months, and the waters would flow again tranquilly in their own channel. I think Sir Morton Peto would contract to do it in half the time."

The inventive faculties of the Americans are at work to produce the best war weapons. According to the modern code of international politics, it is not lawful to block up a harbour which engineering skill can reopen, but it is lawful to invent and use the most deadly engines of destruction imaginable. It is lawful to burn or blow up, or sink a ship with a thousand men on board, in a moment, by some scientific agency; but it is barbarous and contrary to the recognised mode of civilized warfare, to sink a whaler laden with stones in a harbour, and so injure the commerce of your enemy. How differently individuals and nations interpret actions, when performed by themselves or others. British opinion which sanctioned the tying up of rebellious Indians to the cannon's mouth, and blowing them to atoms, is quite shocked at the idea of temporarily injuring a commercial harbour of one of the rebel states. The Americans, according to information we have received, are not likely to give a hostile fleet a kid-glove reception. A correspondent of the *Scientific American* suggests that torpedoes should be used for harbour defences. He would have long beams of timber, shod on one end with iron or steel, and pointed, so as to pierce the bottom of ships, the beam to be anchored with the sharp end, at an angle sufficient to bring it a little under the water, and out of sight. He thinks that it might be still further improved by the addition of a torpedo, which could be easily applied, and made to act with efficacy when struck. The *Buffalo Courier* gives an account of a newly-invented bombshell, or rocket, which was tried in that city a few days ago with successful results. That journal says the rocket consisted of a cylindrical can, one chamber of which contained about a pint of fluid, and the other some three ounces of powder. Upon being fired it exploded and scattered the fiery fluid in all directions. The flames might be estimated at fifty or sixty feet in circumference. The fluid used burned seven minutes, notwithstanding the application of water. Although the experiment tried was on a small scale, we see no reason why ten or twenty gallons of fluid, fired by the same means, might not work terrible destruction to the ships or fortifications of an enemy. We understand that another trial, with a much larger bomb, will be made in a short time.

A few days since the new machines constructed for boring through the Alps, were tried with great success, 730 metres have already been pierced in the French side, and 950 metres on the Italian side; consequently, nearly 1,700 metres, out of 12,000 metres, about seven miles and a half, which have to be bored through.

We have much pleasure in announcing that Mr. J. Luke, Admiralty Inspector of ships building under contract, and of Government mail steamers, has been promoted to the rank of master shipwright, with a salary of £650 per annum, but with no change of duties. Most of our shipbuilding readers, especially those who have read the blue books on the Galway and other mail steamship contracts, will be aware that Mr. Luke has deservedly earned a very high reputation both for professional skill and for inflexible integrity; and they will be glad to learn that his services have been handsomely recognized. The Admiralty Inspecting Officer occupies a position of great responsibility, especially in these days of loose commercial morality; and it is only just to him that he should be placed in a very high professional position, in order to secure him from even the approaches of unprincipled persons. In every way, therefore, the promotion of Mr. Luke is a most judicious and praiseworthy step on the part of the Board of Admiralty, and we take the earliest opportunity of giving them the credit of it.

Mr. Bashley Britten's competitive 32-pounder cast iron rifle service gun, not strengthened in any way, has been tried at the bursting cell, Woolwich, with a view to ascertain its capabilities of endurance under the conditions proposed by him. The gun has now been fired 865 rounds of Britten's projectiles. The rifling appears to be as perfect as at first, and the vent has not enlarged to the extent as to require rebouching, which is usually necessary after 300 or 400 rounds with common round shot. An official experiment made a short time since with this gun at Shoeburyness, proved that the initial velocity of Britten's 50lb shell fired from the 32-pounder cast iron gun, was 12,092 feet per second, with a charge of 5 lbs. of powder, being one tenth part of the weight of shot. The initial velocity of the Armstrong shot with the charge of one-eighth of the weight of projectile is stated by Sir William to less than 1,100 feet. The cost of converting the smooth-bored gun into a rifled-gun is estimated at Woolwich to be about 17s. 6d. each.

The aggregate weight of the three iron masts and bowsprit of the steam frigate Resistance is nearly fifty tons.

COTTON POWDER.—Before the Emperor of Austria returned to Vienna from Venice, he was present at this latter place to witness some experiments in submarine blasting. Two large cases were sunk before him to a depth of fourteen feet in the sea, each containing 400 pounds of cotton powder. The first was then exploded, and a large brig adjoining was blown out of the water to a height of fifty feet and shattered to pieces. The second blew up another vessel as high, it was conjectured, as the tower of St. Mark. The experiments were considered quite successful.

Work in the New York Navy-yards has become slack, the "Mortar Fleet" being nearly fitted out. The expedition for which these vessels were intended was expected to be the last of those about to be undertaken on the Atlantic seaboard, as the Government agents had ceased to charter or purchase steamers and sailing vessels, ferry-boats, canal-boats, and whatever other variety of naval craft they could obtain. The New York shipbuilders were preparing proposals for the 20 gunboats, or, more accurately speaking, "iron-clad steam batteries," which were provided for in a Bill before Congress. The specifications, most minute and elaborate, had been already drawn up. The principal dimensions of the boats will be 216ft. 2in. in length, 48ft. in extreme breadth, and 13ft. 11in. in depth of hold. Each boat is to have two revolving turrets, worked on familiar mechanical principles, and each containing a columbiad of the largest calibre, which, by a movement of the turret upon its axis, can be instantly directed at pleasure to any point of the horizon. The turrets will be 21½ feet in diameter, and about 9 feet high, and will be composed of solid oak 10 inches thick, with an inside iron plating of 2 inches, and an outside iron plating of 3 inches. At the ends of the hull the plating will be 3¼ inches thick; for a space of 15 feet from either end 3¾ inches thick; and over the rest of the vessel 4¼ inches thick. The iron must be subject to a test equal to a tensile strain of 55,000lb. on the square inch. The estimated entire weight of the plates is about 690½ tons.—*Times.*

The Paris Correspondant of the *Times* says, it is satisfactory to find that, emulating the operations of the National Lifeboat Institution of England, some of the maritime nations of the continent are making vigorous exertions to establish lifeboats on their shores. The Spanish Government has recently had seven lifeboats built in England for its coast, and others are in course of construction for that country. Lifeboat stations are increasing on the shores of the Baltic. The Italian Government is erecting new lighthouses, and lifeboat stations must, of course, follow. The system of lighthouses on the French coast is an admirable one, but it is to be regretted that it continues to be unprovided with sufficient lifeboats.

A laudable effort is about to be made to provide more suitable accommodation for the valuable and increasing libraries and other property of the various scientific societies of Glasgow. The following "Suggestions" are now under consideration in that city:—"That all the learned and scientific societies of Glasgow be brought together into one building, to be built in some suitable situation, and to be named 'The Royal Institution Buildings,' with a royal charter. The societies only to be so far united as to carry out the desired object of mutual accommodation and assistance, at the least joint expense. Each society will retain and maintain its own library and other property, with its own distinct management and funds, as at present. Each society will pay a proportional rent to the institution, for maintenance, salaries of attendants, &c., as may be afterwards arranged. All the libraries to be kept together in one library, hall, or reading room, under the principal librarian, with assistants—the library room to be fitted with every comfort and convenience for consulting, reading, and writing. A large hall for general meetings to be provided, and such smaller rooms as each society may require. A general museum for the reception of models and drawings—mechanical, architectural, or otherwise—and geological and archæological collections."

"Carbo," in a letter on the Hartley Colliery accident, says:—"The methods made use of to get these poor fellows out of the pit are such as would at once suggest themselves to persons engaged in these matters, but there is one method which it seems to me would have been quite effectual in much less time, and more perfect. Had they taken the other half of the beam, weighing 20 tons, slung it in a chain, let it down the pit, and worked it as a battering-ram or pile-driver on the top of the rubbish, so great a weight and force must in 20 minutes have crushed the whole accumulated mass of rubbish to the bottom of the pit. I must premise that the obstruction took place a few feet above where the yard coal seam is cut by the only shaft by pieces of timber lodging across the pit. Now, no timber of dimensions to resist such a force as 20 tons is ever made use of in a shaft for brattices, and I feel perfectly satisfied that this means would have saved all these men's lives. Had the half of the beam not existed, ready to hand, it was only to send over to Tynemouth, and borrow from the Castle one of the largest guns, which I believe, if slung in a similar manner, would have been equally efficacious. Again, as soon as carbonic oxide began to show itself, lime water should have been freely used and dashed about, which would at once have absorbed the carbon, and rendered the air pure. Six parts of carbon and eight parts of oxygen form carbonic oxide; six parts of carbon and 16 parts of oxygen make carbonic acid; besides carbonic acid is heavier than air, and subsides; carbonic oxide, being lighter, rises."

STEAM ON COMMON ROADS.—On Tuesday last, a heavy marine boiler was successfully removed from the works of Messrs. John Laird, Sons, and Co., Birkenhead, to the large crane situate on the margin of the Great Float, by means of Taylor's (Britannia Engine Works) "steam elephant," and a second boiler was removed on Friday. This is the first instance in this neighbourhood in which steam on common roads has been employed for such a purpose. Judging from the easy manner this machine was guided over the roads, it promises to become a most useful agent for transporting heavy loads, and it is equally applicable for discharging timber out of ships and afterwards drawing it upon the quay or from place to place, as required. One of these engines, manufactured by Messrs. J. Taylor and Co., of Birkenhead, has, we understand, been at work for this purpose in her Majesty's Dockyard at Devonport, for upwards of two years, with great success.—*Liverpool Mercury.*

INCRUSTATION OF BOILERS.—Our Northumberland correspondent refers very fully to the inquest upon the sufferers by the Byer Moor Colliery boiler explosion, recording the opinion of the jury that an incrustation of 5-16ths of an inch in thickness had formed in the boiler in less than four days, and that the workmanship, materials, and fittings of the boilers were good, and sufficient for the safe working of the boiler. This verdict was, doubtless, satisfactory to those concerned in the working of the boiler, and was probably the only one that could be expected from a coroner's jury, but it is very questionable whether the scientific world will permit the matter to pass without much further discussion, as, from the report of Messrs. Richardson and Browell, it would certainly appear that nothing like the 61·70 grains per gallon was at all likely to be precipitated. Messrs. Richardson and Browell found that the contents per imperial gallon was—earthy carbonates, precipitated by boiling, 12·70 grains; fixed matters in solution, not precipitated by boiling (concentration and evaporation being provided against), containing 25·42 grains sulphate of lime, besides other sulphates and chlorides, 49·00 = 61·70 grains of solid matter in the gallon. *Mining Journal.*

PRODUCTION OF CORK.—In the *Mémoires de la Société de Physique* of Geneva (recently received) is an interesting paper by M. Casimir de Candolle on the growth of cork. Although this useful substance exists in varying quantity in the bark of all phanerogamous plants and in several cryptogamous, yet for commercial purposes it is wholly procured from two species of oak, Quercus occidentalis, growing in the south-west of France and in Portugal, and from Quercus suber (the cork tree), growing in the south-east of France, in Italy, in Algeria, and in the isles of the Mediterranean. The acorns of the former species take two years to ripen. In 1859 M. C. De Candolle, while staying in Algeria, studied the development of the bark of the latter species. It is composed of four layers—the epidermis, the corky envelope, the cellular envelope, and the liber which covers the soft wood. These four parts increase independently of each other year by year. In the third or fourth year the epidermis, having attained the limits of its elasticity, splits longitudinally, and a marked change takes place in the corky envelope, which gradually takes up the appearance of true cork: new layers are produced, and the transformation of cellulose into cork steadily goes on. The cork thus naturally developed has no commercial value. It is termed "male;" and the first act (*démasclage*) of the cultivator is to separate it from the trunk, which thus leaves exposed the liber, termed "mother." The tree is then left to itself, and the cork begins to grow again, whilst the sap is flowing in consequence of the exposure of the liber. If a trunk left in this state for several months be cut down, in the section a ring of cork will be found formed in the interior of the "mother," at a variable distance from the surface of the trunk. All the exterior portion of the "mother" is dead, and splits as the tree goes, and the interior portion (new cork, termed "female") is developed. This "female" cork grows in the same manner as the "male," that is, by the addition of annual layers on the internal surface; but it is much finer and more elastic, and is the cork of commerce. These various stages of growth are exhibited in a series of beautiful plates. In the course of his researches M. De Candolle was led to observe the importance of the desiccation of the "mother," and to infer that, in proportion as this desiccation could be hastened, so much sooner would fresh layers of cork be produced. This idea he found to be correct. He observed several trees in which fires, after having charred the male or female cork, had determined the formation of a layer of female cork in the interior of the "mother." He states that he has seen a specimen, composed of three layers of "female" cork, separated by little zones from the "mother;" the fourth layer, which enveloped the whole, having disappeared in consequence of the fire. The thickness of these zones, increased by the application of boiling water, does not diminish by cooling. Other peculiarities of this remarkable substance are noted in the memoir.—*Illustrated London News.*

THE GREAT UNDERGROUND TREASURY.—The wealth of England is so intimately connected with her mineral resources, that like a careful trader she annually "takes stock" of all her operations, and publishes the returns—having no reason to be ashamed of them—for the information of the world. Our capital, our machinery, our skilled artizans, might all emigrate, if our home-born supply of coals and iron were to fail. The materials could, indeed, be brought to us from abroad, but it would be cheaper still, as the prophet found it of old, to go to the uncomplying mountain. When we visited Swansea in 1848, there were ships in her docks laden with Australian copper ore, and ship-loads of Australian ore encumbered the quays. Cottages ornamented their window-sills with malachite and azurite, and bordered their garden-plots with the green and blue mineral. It is not so now; the colonists import our coal instead of sending us their ores, and the produce of the Burraburra is smelted at the mines. Sir Henry de la Beche, in the Inaugural Discourse at the opening of the School of Mines, in November, 1851, valued the mineral produce of Great Britain and Ireland at twenty-four million pounds per annum, or about four-ninths of that of all Europe, including these islands; an amount more than three times greater than the mining produce of Russia and Poland, and four times that of France. In Mr. Hunt's "Mineral Statistics for 1860," the returns exhibit a total amount of thirty-seven millions, exclusive of the building-stone, brick-earth, and similar materials, estimated in the statistics of the previous year at nearly eight millions sterling. The coal returns for England and Wales, during the year 1860, show an extraordinary increase. It may be remembered that in Mr. Hull's "Coal Fields of Great Britain," the coal raised in 1858 was stated to be 37 million tons, and the *present and future* produce was estimated at 60 millions. Upon this assumption the coal fields of England and Wales it was calculated, would last 1,000 years; whereas upon our estimate of the present rate of *annually increasing* consumption, we should exhaust all our available coal in the space of a century. The actual produce of 1859 was 61½ millions of tons; and last year it mounted up to 69 millions, or with the addition of the Scottish coal mines, to 80 millions; besides which, there were four million tons of small coal left useless on the pit banks. At this rate there can be little doubt we shall raise 90 million tons of coal by the year 1870; and the only check we can anticipate will arise from the overgrowth of the mining population, already estimated at half-a-million by Professor Morris in his recent lectures on coal. The total amount of coal exported in the year 1860 was 6,788,060 tons, being little more than the total of the preceding year; while the exportation to France has experienced a slight falling off. Next to coal, the most important articles are copper, iron, lead, and other metals, the value of which will be shown most readily by Mr. Hunt's summary of the mining produce of Great Britain and Ireland for two years.

	1859.	1860.
Coal	£17,994,951	£20,010,674
Iron	11,138,712	12,703,950
Copper	1,734,700	1,706,291
Lead	1,410,095	1,417,415
Tin	929,390	871,382
Silver	158,407	151,173
Zinc	75,782	89,536
Other Minerals	95,000	170,927
	£33,537,027	£37,121,318

The Critic.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c., 1702, 1744, 1746, 1750, 1757, 1763.
BOILERS AND THEIR FURNACES, &c., 1750.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1697, 1703, 1747.
SHIPS AND BOATS, including their fittings, 1715.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1724, 1735, 1742, 1752.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, *None.*

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1694, 1709, 1712, 1720, 1728, 1764.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1707, 1713, 1719, 1721, 1738, 1745.
Lighting, Heating, and Ventilating, 1711, 1714, 1717, 1739, 1741, 1748, 1762.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1696, 1699, 1701, 1708, 1716, 1723, 1730, 1731, 1733, 1740, 1749, 1751, 1753, 1755, 1750, 1761.
Metals, including apparatus for their manufacture, 1695, 1706.
Chemistry and Photography, 1704, 1722, 1726, 1732, 1734, 1756.
Electrical Apparatus, *None.*
Warfare, 1729, 1758.
Letter-Press Printing, &c., 1763.
Miscellaneous, 1698, 1700, 1705, 1710, 1718, 1725, 1727, 1736, 1737, 1743, 1754.

1694. J. Petrie. *Improvements in machinery or apparatus for washing and drying wool, cotton, and other fibrous materials requiring similar treatment.* Dated July 3, 1861.

This refers, 1, to a method of driving such feed aprons of machines for washing wool, &c., as are caused to travel by rollers, which act independently of those over which the apron passes, and consists in causing the said rollers to bite upon strips of leather, india-rubber, or other flexible material, so as to prevent them from acting upon the said apron direct. Another part consists in drying cotton, by causing a current of air, heated, or at the ordinary temperature, to be driven through the material by the exhausting or blowing action of a fan or fans. *Patent completed.*

1695. P. Spence. *Improvements in economizing the manufacture of sulphuric acid, and in obtaining copper from ores used in such manufacture.* Dated July 3, 1861.

This consists essentially in submitting such ores to the action of a roasting heat as they are passed from one end of a furnace to the other, during which transference a current of air is caused to travel over them in an opposite direction. To accomplish this the patentee uses a furnace of considerable length, having several doors, for introducing apparatus by which the transference may be effected. *Patent completed.*

1696. V. C. Givey. *Improvements in sewing machines.* Dated July 3, 1861.

According to this invention certain connecting arms, links, or connections, are used for transmitting motion, the same being jointed or properly connected to the parts from which they derive, and to those to which they communicate their motion. We cannot here give space to the details of this invention. *Patent abandoned.*

1697. J. Patterson. *Improvements in machinery for applying the power of horses or other animals to drive mills or other machines.* Dated July 4, 1861.

This invention is carried into effect by mounting a mill or other machine upon a carriage with travelling wheels, so as to be portable, and so that, when the carriage is connected to a fixed centre attached to the ground or floor on the place, where the machinery is used, and is moved round such fixed centre in a circle by any animal or animals yoked to the carriage, the mill or other machine is driven by the action of the travelling wheels. *Patent abandoned.*

1698. J. Rull and C. A. Caspar. *Level measurements on an entirely new principle called "level balances."* Dated July 4, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1699. R. Mills. *Improvements in washing, wringing, and mangling machines.* Dated July 4, 1861.

Here the inventor makes the bowls of cast iron, and covers the surfaces with zinc, tin, &c. He casts them hollow with the shaft through and attached, and he injects steam into them to assist the drying of the goods. The said rollers are applicable to domestic machinery, &c. *Patent abandoned.*

1700. J. M. Gale, and T. Kennery. *Improvements in taps or valves.* Dated July 4, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1701. W. H. Ludford. *An improvement or improvements in the manufacture of brooms and scrubbing brushes.* Dated July 4, 1861.

The patentee claims fixing bristles or fibres of the said brooms and scrubbing brushes in continuous lines or rows, by forcing the said bristles or fibres into grooves, channels, or troughs, made in the broom or scrubbing brush head, and securely holding the said bristles or fibres in their places by blocks or wedge-shaped pieces driven into the said grooves, channels, or troughs, and fixed by pins or screws. *Patent completed.*

1702. W. E. Newton. *Improvements in engines for obtaining motive-power, part of which improvements may be employed by sounding steam-whistles.* Dated July 4, 1861.

By means of the present invention, whereby the apparatus is made self-acting, or nearly so, in its operation, the air is introduced, and commingled with the steam through the agency, and by the power of the current of steam itself, on its way from the generator to the working cylinder of the engine, and by the vacuum produced in the working cylinder during a certain portion of the stroke of the piston. *Patent completed.*

1703. J. Webster. *Improvements in compositions for lubricating railway and other axles.* Dated July 4, 1861.

This consists in the production of a composition or grease which does not melt or run on the application of heat even at very high ranges, and continued for a long time. *Patent abandoned.*

1704. J. Wilson and J. G. Tatters. *Improvements in heating tank refuse or soda waste.* Dated July 4, 1861.

Here the inventors take the residue commonly called tank or soda waste lixiviate it with hot water, and boil it if necessary. They then filter the liquor, and into the filtered liquor they pour muriatic acid, till all the sulphur is precipitated. They then decant, draw off or filter the liquor, and thus separate the sulphur, which they wash in order to remove the acid, the sulphur is then dried. *Patent abandoned.*

1705. M. A. F. Mennons. *Improvements in the construction and arrangement of apparatus for the manufacture of ice, and for the refrigeration of solid and fluid masses in general.* (A communication.) Dated July 4, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1706. B. G. Sloper. *An improved method of, and machinery for amalgamating and for effecting the separation of gold from earthy and other matters containing the same.* Dated July 4, 1861.

This invention is intended to effect the separation of particles of gold from earths and quartz, after being crushed or reduced to small particles, or pulverised, by bringing mercury in contact therewith, as hereafter stated. The machinery consists of a hopper opening at bottom into a cylinder placed horizontally, or nearly so, and fitted with agitators secured to a vertical shaft made to revolve in the hopper. Inside the horizontal cylinder, the inventor places, and causes to revolve, an archimedian screw, and crushed rocks or auriferous earths are introduced together with mercury into the hopper. At the opposite end of the cylinder to that at which the charge is admitted, there is an outlet into a vessel furnished with sieves of different degrees of fineness, and containing a set of channels or passages, communicating at one end with a fan or blower, while they are open at the other to receive the mercury and gold in the state of amalgam, the air driven through them preventing the entrance of all matters of less specific gravity; the action of the vessel is assisted by a shaking or jogging motion being imparted to it. From the lower part of this vessel the amalgam falls into a cylinder in which an agitator is caused to rotate, whereby the globules of amalgam are beaten into one mass, and until this mass is sufficiently rich in gold, it is pumped back to the hopper, with fresh crushed quartz or auriferous earth to act and be acted upon as before. *Patent abandoned.*

1707. B. Fowler, Jun. *An improved sewer and sink trap.* Dated July 5, 1861.

This invention consists of a square or other suitably shaped box, formed of iron, clay or other suitable material, having the sides thereof flanging outwards from the bottom upwards, and having on the upper edge a ledge surrounded with a lap, upon three sides of which the lid rests when closed. The back ledge is formed a little lower than the front and side ones, and the back of the sides of the box is hollowed out to receive the legs on the under side of the lid, by which it is jointed to the sides of the box by a horizontal transverse pin or pins. The bottom of the box is formed with an oblong hollow truncated pyramid, which rises some distance inside of the box, and is open at the top. The grated cover or lid is cast with an oblong box in the centre, which, being open on the under side, surrounds the top of the truncated pyramid escape port when closed, but is not in contact therewith, the inverted box being sufficiently large to allow the water to pass up into the inverted box on the under side of the lid, and escape through the opening on the top of the truncated pyramid into the sewer, the sediment remaining in the bottom of the box, from which it can be readily removed. *Patent abandoned.*

1708. J. Hutson. *Improvements in cornices, laths, and panels, for bedsteads and other articles of furniture.* Dated July 5, 1861.

The cornices are, according to this invention, made of metal, for which purpose the patentee prefers to use thin sheet metal, forming the large sweeps or curves or angles by passing the said metal between rollers of corresponding size and form, and the smaller sweeps or curves or angles by stamping or pressing the same into form, and afterwards soldering or suitably securing together the parts of the said cornices by the method commonly adopted in metallic constructions. In the construction of the cornices, the rounded corners, then used, are formed of stamped or cast metal, which is soldered, rivetted, or secured to the other parts of the said cornices, the weight of the cornice being supported by the invisible or reversed brackets before described. The short laths for iron bedsteads have one stud hole punched out in a line with the lath's length, as heretofore, but the other stud hole is punched out at right angles or nearly so with it; and in addition one or all of the long laths, and (if thought necessary) one of the short laths used in each bedstead, may be provided with tongues punched out and turned under at the point where the said laths pass over or cross each other, and when fixed in position the said tongues are slid under each of the laths and retain the same in position. And in order to enable laths secured together in this manner to be tightened or slackened, as may be required, the patentee attaches to the long laths a rug lever or annular fastener, or other adjusting fastener. The panels aforesaid are constructed of corrugated metal. *Patent completed.*

1709. O. Williams. *An improved mixture or liquid for extinguishing fire, applicable also for preparing or saturating various kinds of materials and fabrics, for the purpose of rendering the same non-inflammable.* Dated July 5, 1861.

The patentee claims combining into a mixture water, soda of commerce, alum of commerce, roach alum (or mineral salt), common salt, borax, oil of vitrol, and chloride of zinc, and the use and application of the said mixture for extinguishing fire, and rendering materials and fabrics uninflammable. *Patent completed.*

1710. W. E. Gedge. *Improvements in obtaining motive power.* (A communication.) Dated July 5, 1861.

Provisional protection has not been granted for this invention.

1711. J. E. Melon de Pradon and L. G. Lecoq. *Improvements in apparatus for lighting.* Dated July 5, 1861.

This consists in the use of a pipe or conduit on which the gas burners are mounted, the whole being enclosed in reflector, the interior of which will reflect the luminous rays and throw them on a polished or unpolished glass Screens of various colors are placed at will, so that the lighting can be obtained in the tone required. *Patent completed.*

1712. R. Lakin and J. Wain. *Improvements in certain machines used in preparing to be spun, and in spinning, cotton, wool, and other fibrous substances.* Dated July 5, 1861.

This invention consists, first, in its application of vertical levers, in combination with other suitable parts, for the purpose of forming a connection between the fallers of two or more mule carriages, when driven from one head stock, only in the manner commonly called double decking, triple decking, or the like, according to the number of carriages connected, so that the motion given from the head-stock to the faller of one carriage may be communicated to the faller or fallers of the other carriage or carriages. Secondly. In constructing the cap-bar slides, and cap bars used to retain the top rollers in the mule or throstle in their places, in such manner as to act as stoppers in removing the fibres of cotton or other material, which are apt to gather round the pivots of such rollers. Thirdly. In the improved construction of the cap bars and cap-bar slides, in such a manner that the ordinary saddles may be dispensed with when fluted top rollers are used in any of the machines of the several kinds before-mentioned, and the parts used for weighting the top rollers may be attached to the cap bars or cap-bar slides, whereby the parallelism of the top and bottom fluted rollers is less liable to be disturbed. Fourthly. In the application in or to any of the machines of the several kinds aforesaid of a click and ratchet wheel, in combination with pulleys of unequal diameters to produce different speeds in the same shaft. Fifthly. In a combination and arrangement whereby the scrolls or equivalent parts used in putting up the mule carriage, and also the piston wheel for performing the backing off, are driven by gearing attached to a counter-shaft, and through intermediate parts, instead of being driven from the head-stock in the usual manner. Sixthly. In the application of a spring or brake to prevent the rotation of the winding-on barrel or drum, in mules, constructed on the principle of Roberts' mules, during a short period before the carriage has completed its outward run, and also after the carriage has commenced its outward run and thereby to allow an interval between the commencement of the inward run and the commencement of the winding-on. Seventhly. In the application of a catch box and incline, in combination with a snail and other suitable parts, for the purpose of moving the mule carriage inwards at a slow rate whilst twisting at the head, the motion being determined by the form of the snail, which acts when the catch is in gear, the time of which is regulated by the incline. *Patent completed.*

1713. W. England. *An improvement or improvements in the manufacture of bricks.* Dated July 5, 1861.

This consists in moulding bricks in such form that no mortar bed or point is perceptible upon the face of the work, a rebate or flange upon the edges of each brick concealing the joint. *Patent abandoned.*

1714. L. Roughton. *Improved apparatus for extinguishing fires.* Dated July 5, 1861.

In applying this invention to a warehouse of two or more stories, the patentee arranges at different elevations water pipes which shall be capable of discharging jets of water on to any desired floor. If the warehouse is situate in a town provided with a public supply at high pressure, he runs up a standard pipe from the street main, and connects therewith horizontal pipes from which he may lead branch pipes, distributing them over the building, either above or immediately below the different floors, and at suitable distances apart, so as to spread the supply equally over the whole of the building. In these branch pipes, supposing them to run along under the floor of the different stories, he fits pendent valve boxes which from vents for discharging the water in jets to the space below, and by suitable means in connection therewith he is enabled to act automatically, or without manual aid, in cases of imminent danger. *Patent completed.*

1715. J. Dean. *Improvements in machinery or apparatus for propelling vessels.* Dated July 6, 1861.

In carrying out this invention, the patentee mounts several cylindrical frames on axles or shafts, each frame having several floats, say four, six, or any other convenient number. The revolving frames, of which there may be three or any greater number, are mounted upon a main frame, of square, polygonal, or circular form, having a central axis or shaft supported in main bearings, and as an equivalent for the ordinary shuttle-shaft. This shaft in a single propeller, may be supported at each end within the vessel, or where employed as side wheels or propellers and overhanging the side of the ship, the inner bearing may be taken by a block on the deck or side of the ship, or in an opening cut for that purpose, whilst the outer or overhanging end is carried by the "spring beams." Each of the revolving frames has fixed upon its axis a toothed pinion, or its equivalent; these take into and receive motion from, and by means of, a circular rack or internal toothed wheel affixed to the ship's side, or within the propeller box or casing, and upon motion being communicated to the main revolving frame or carriage in which they are mounted, they are made to revolve, and each of the floats or float-boards in turn is made to dip, to perform its work, and withdraw. The floats enter the water behind the line of the main shaft, instead of, as in the ordinary paddle-wheel, before the line of the main or paddle-shaft. This propeller is more particularly intended for river and other shallow water navigation. *Patent completed.*

1716. J. R. Black, and H. W. Spratt. *Improvements in the manufacture of boxes, cases, tubes, rings, and such like articles, and machinery for the same.* Dated July 6, 1861.

This consists in a mode of constructing and manufacturing boxes, cases, tubes, rings, and other such like articles (some of which have been usually made of pasteboard, or thin wood and paper), by moulding and forcibly compressing into the form required pulp, made from vegetable or animal fibres, in conjunction with earthy matter, starch, size, gum, oil, glycerine, resin, or other similar stiffening substance. The machinery is constructed as follows:—The patentees use a mould or die to receive the pulpy substance. They then use one or two plungers, to mould and forcibly compress it into the form required. The mould is pierced to permit the air and water to pass through it. When two plungers are used, they withdraw the first and supply its place with air driven through its centre. Before removing the second plunger the moulded article is delivered from the mould by another plunger, and is then removed into a drying room. *Patent completed.*

1717. R. A. Smith. *Improvements in purifying gas.* Dated July 6, 1861.

The patentee claims the purifying of gas from sulphur and its compounds, except sulphuretted hydrogen, by treating it with alkaline solutions of certain metals, in the manner described. *Patent completed.*

1718. T. Wilson. *An improvement or improvements in moveable spanners or screw wrenches.* Dated July 6, 1861.

This consists in actuating or adjusting the moveable jaws of moveable spanners or screw wrenches, by means of a screw, one part of which is right handed and the other part left handed. One part of the said screw engages with the moveable jaw, and the other part engages with the body of the wrench, or with the fixed jaw of the wrench. Between the right and left handed portions of the screw is a milled head or collar, in one or other direction; the moveable jaw may be removed and adjusted to the required distance from the fixed jaw. It further consists in the arrangement or combination of certain parts of moveable spanners or screw wrenches, and in the manner of putting together certain parts of moveable spanners or screw wrenches. *Patent completed.*

1719. J. E. Reid. *A safety window sash fastener and draught excluder.* Dated July 6, 1861.

This consists of a hollow bar of brass or other metal, fixed horizontally on (and the entire width of) the upper side of the meeting rails of sashes to ordinary windows, immediately over the cavity formed by the junction of the inner and outer sash. It is fixed by a continuous hinge partly let into the wood of the inner sash rail, and being in shape half round, or semi-circular in section, it forms, when closed, a bridge over the before named cavity, its opposite edge falling into a small groove cut in the outer sash, thereby effectually excluding all draught. The ordinary catch of the present sash fastener is not required, in lieu of which the hollow bar is made solid in the centre or joint opposite the bolt, and a quadrant shaped slot is cut in a horizontal direction to allow of the free traverse of the spindle of the bolt. *Patent abandoned.*

1720. H. Scutt. *Improvements in spinning frames for spinning wool, cotton, silk, or flax and other fibrous material.* (A communication) Dated July 6, 1861.

This invention consists of a contrivance to cause the thread of yarn which is being spun, when it chances to run into curls and entangled hard spun lumps, to cease spinning, and to cause the prepared material which was being spun to wind round the rollers in the shape of what is termed soft waste, suitable to be again prepared for spinning, instead of hard waste yarn of little value. *Patent completed.*

1721. T. Smith. *Improvements in the construction of bells.* Dated July 6, 1861.

This consists in constructing bells of glass, by first casting them in moulds in a similar manner to metal bells, and then annealing them so as to prevent them from cracking through sudden changes of temperature. *Patent abandoned.*

1722. W. Pask. "*Procuring a very valuable colouring matter from iron stone of so inferior a character as usually to be thrown aside as worthless, both in the manufacture of iron and of colouring matter.*" Dated July 6, 1861.

Here the patentee takes a quantity of the mineral or refuse of iron stone, and puts it into a cast iron mill with iron or stone runners or rollers, fluted and plain, worked by horse, or steam, or water power, in which mill be crushes or pulverises such mineral, and brings the whole into a fine powder. He then puts this powder into a tub or tank containing water, and washes it by stirring it about, either by the hand, or by a process called tossing or tozing, when the colouring at a particular stage of the washing is suspended in solution, and the heavier or gritty substances sink. He then instantly pours off the water containing such colouring matter into another vessel, and allows this to stand for the space of six hours, or as long as may be necessary, and it appears the colouring matter or sediment has all sunk to the bottom; at this time he pours off the water from the colouring matter, which by this time has been precipitated to the bottom of the last named vessel, and collects it together. He then puts the sediment—which is in fact the colouring matter obtained as before stated—into a stove constructed of fire clay or brick, and therein dries it, when the colouring matter is perfected and rendered fit for use. *Patent completed.*

1723. J. Ridsdale. *Improvements in inkstands, applicable to the stoppers of bottles.* Dated July 6, 1861.

This relates to those inkstands in which a portion of the ink is raised into a dipping cup for use, and lowered therefrom when not required, by means of a stopper having a small hole formed through it, the said stopper operating as a piston which, when depressed, forces the ink up the hole therein. This invention consists in a method of packing the aforesaid sliding stopper or dipping cup, by forming a groove or recess in the neck of the inkstand, or by forming two internal flanges therein, into or between which is placed a loose ring of vulcanized India rubber, or other elastic material. The sliding stopper aforesaid fits into the said ring tightly, and by these means is kept air-tight. *Patent completed.*

1724. L. A. Keiley and W. A. O'Doherty. *A certain improved method of, and apparatus for facilitating the process of grass edge cutting, or edge cutting in general.* Dated July 6 1861.

Provisional protection has not been allowed for this invention.

1725. C. Farrow. *Improvements in apparatus for affixing or applying capsules to the necks of bottles and other vessels.* Dated July 6, 1861.

Here the inventor employs a number of small wheels, and the bearings of the axles of the wheels are arranged so as to be capable of being moved to and from a common centre line, towards which they are continually pressed by springs; the neck or mouth of the bottle or other vessel on which a capsule is to be fixed, is, with the capsule upon it, placed between the wheels; the frame carrying the rollers and their bearings is rotated so as to cause the wheels to run round on the capsule while they are pressed against it, and thus the capsule is secured. *Patent completed.*

1726. A. Noble. *Improvements in obtaining products from alkali waste and gas lime refuse.* Dated July 6, 1861.

For the purposes of this invention, alkali waste is allowed to stand in a heap or in vats for a few days, after which water is poured upon it, and it is permitted to remain on it for a short time; the liquor is then run off. This liquor, or the liquor which drains from alkali waste heaps, is mixed or brought in contact with sulphurous acid, either in a gaseous state, or in solution. By these means sulphur is precipitated in a marketable form; the clear super-natant liquor also contains hypo-sulphate of lime. This solution of hypo-sulphate of lime may either be boiled down to obtain solid hypo-sulphate of lime, or may be decomposed with carbonate of soda to obtain hypo-sulphite of soda, or may be decomposed with hydrochloric acid to obtain sulphur and sulphurous acid. In like manner the refuse from lime purifiers of gas works, is treated to obtain like products. *Patent completed.*

1727. E. R. Handcock. *Improvements in machinery for obtaining and applying motive power.* Dated July 6, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1728. G. Tutill. *Improvements in treating materials for the manufacture of banners and flags.* Dated July 6, 1861.

The patentee claims the application to silk and other light materials to be made into banners, flags, &c., of india rubber, either in combination or not with oil, to be followed by a coating of paint as described. *Patent completed.*

1729. J. Snider Jun. *A method of utilizing old or smooth bore cannon by strengthening and rifling, them so as to render them efficient to fire elongated or cylindro-conoidal projectiles.* Dated July 8, 1861.

This is carried into effect by first reboring the cannon to be converted to a sufficient extent to rectify any inaccuracies arising from wear and tear or long exposure, and then inserting in the said cannon a hollow close fitting metallic cylinder, preferably of steel, whereby greater strength is given to the piece, and the diameter or calibre of its bore proportionally reduced. The said cylinder is secured in the gun by any adequate mechanical means; after which the bore can be completed and the piece rifled. *Patent abandoned.*

1730. F. Warner and T. Clark. *Improvements in apparatus for supplying water to water closets.* Dated July 8, 1861.

This consists in a combination of apparatus (the details of which we cannot quote here) whereby, among other advantages, only a determined supply of water shall be supplied to the basin of the water closet each time the closet is used. *Patent abandoned*

1731. R. Hornsby Jun. *Improvements in machinery for washing, wringing, mangling, and churning.* Dated July 8, 1861.

This relates to a previous patent granted to the present patentee, 10th October, 1860 (No. 468,) and consists in fixing two handles on the axis of the tub outside the frame or standard by which the axis is carried; the handles project upwards from the axis and are placed at an angle of about 45° the one to the other. The patentee makes the joint between the lid and the tub with felt or other soft material, and to force the lid in contact with the tub he places lugs on the tub inclined on the underside; and he uses a cross bar also inclined at the ends, and which to fix the lid is placed thereon and turned round, so that its ends pass under the lugs; the inclines then press it down on to the lid. The invention also consists in an arrangement of apparatus for keeping the upper roller down towards the lower in mangling machines when combined with the previously described apparatus. *Patent completed.*

1732. T. Cobley. *An improved process for the manufacture of fluo-silicates and silicates of lead and baryta, and for the application of the same to various purposes in the arts and manufactures.* Dated July 8, 1861.

The patentee claims the manufacture and use of fluo-silicates of lead and baryta, by the method, process, and means set forth, and the application of the same either separately or together, to the manufacture of glass and porcelain, either as a glaze or as a pigment, and either applied and used as direct or real fluo-silicates, or by the admixture of any salt of lead or baryta with any fluoric, siliceous or fluo-siliceous material, so as to obtain the same results as if a fluo-silicate had been actually used. *Patent completed.*

1733. T. T. Macneill. *Improvements in the construction of barometers, and in apparatus for registering the indications of the same.* Dated July 9, 1861.

This invention consists in a method of multiplying or increasing the indication of the variable heights of the column of mercury in barometers to such an extent that the small variations in height, which are scarcely appreciable in barometers of the ordinary construction, may be read off with the greatest facility. *Patent completed.*

1734. T. Cobley. *An improved process for the treatment of silicates of metallic and non-metallic bases and other siliceous compounds, as slags, scoriæ, and such like, in order to recover the said bases, and also in the production of fluo-silicic and silicic acids.* Dated July 9, 1861.

The patentee claims, 1, the application of fluorine for desilicising metallic and non-metallic bases, as described. 2 The manufacture and production of fluo-silicic acid and silica by the same process simultaneously and in combination with the process for desilicising mineral products, as described. *Patent completed.*

1735. A. Priest and W. Woolnough, Jun. *Improvements in machinery for drilling and hoeing land.* Dated July 9, 1861.

This consists, 1, in turning drills and hoes at the headlands by providing a turntable upon which the wheel may be placed and turned. 2. In raising or lowering the horizontal bar or bars which carry the fixed ends of the levers of drills and horse-hoes, and in the facility afforded for taking the implement out of work while in motion. 3. In making the wearing parts of drill coulters loose or detached from the body of the coulter itself. 4. In drilling or sowing compost or artificial manures. The box of the drill has hitherto been made whole, the manure being carried to the barrel that delivers it by stirrers placed inside. This last improvement consists in making the front part of the box nearest the bottom to oscillate by eccentrics or cranks driven by gear wheels or otherwise, so that at each motion of this vibrating door a regular quantity of manure is continually supplied to the barrel that delivers it into the spouts or distributing tool. *Patent completed.*

1736. G. S. Parkinson. *Improvements in perforated materials in combination with india-rubber.* Dated July 9, 1861.

Here the inventor takes canvas, paper, felt, or other similar material of the required width, and surfaces the same on one or both sides by the usual process with india-rubber, with or without its usual compounds, and he utilizes the same or not as desired. He perforates the canvas, paper, felt, or other material by machinery, and thus obtains any required pattern perforated through the substance of the same. If he so desires, he embosses the parts left unperforated, and also proposes moulding fibrous materials to obtain a similar result. *Patent abandoned.*

1737. E. A. Penley. *Improvements in the construction of drawing boards.* Dated July 9, 1861.

Here the object is to strain sheets of paper upon drawing boards without the necessity of using glue or other cement. The inventor proposes running an acute angular channel around the back of the board a short distance from the edge over which the edge of the paper is to be brought; wooden flaps are hinged on to the back of the board and are provided with angular strips of wood to fit the channels. These hinged flaps are pressed down upon the edges of the paper which are turned over from the front, and the entire sheet becomes tightly strained without the use of paste, glue, or cement. *Patent abandoned.*

1738. F. S. Barff. *A new or improved process for the induration and preservation of stone and other analogous substances or materials, which process is also applicable to the production of artificial stone.* Dated July 9, 1861.

This consists in using solutions of the alkaline silicates combined with the aluminate of potash or other suitable re-agent in such proportions as to allow sufficient time to elapse for manipulating the said solution, and thus enabling it, when applied to the surface of the stone or otherwise, to enter into and effectually penetrate the same. The solutions in combination with powdered pumice stone or other like material are also used for producing artificial stone for attrition building, &c. *Patent completed.*

1739. W. C. Parkinson. *An improved frictionless bearing for gas-meters.* Dated July 9, 1861.

Here the patentee points the shaft, and places a piece of glass or other material, as flint, pot, china, stone, or earthenware in place of the socket for the point of the shaft or spindle to work upon, thus reducing the friction to a minimum, also the bearings cannot get fouled by the dirt accumulating round them, as the point of the shaft wears away the dirt as it gathers. *Patent completed.*

1740. J. Keats, and G. E. Keats. *Improvements in sewing machinery.* Dated July 9, 1861.

The patentees claims, 1, the means for operating the shuttle, whereby they are enabled to adopt various sizes of shuttle to the same machine, by merely changing the shell or carrier attached to the reciprocating slide. 2. Actuating the needle bar and presser from the same cam, as described. 3. Adapting to the same bridle-piece pressers, capable of feeding the cloth, either at right angles to or in a line with the course of the shuttle, and operating the same as described. Lastly, regulating the tension of the vertical needle thread, by a coiled spring, capable of adjustment as described. *Patent completed.*

1741. C. Cochrane. *Improvements in treating gas in its passage from blast furnaces to the furnaces, stoves, boilers, or other heating apparatus where gas is employed.* Dated July 9, 1861.

This consists in applying to a blast furnace exhausting or forcing machinery, together with a scrubber or apparatus capable of dividing the gas, after it comes from the head of the furnace, into very numerous minute streams and divisions, and capable of subjecting the gas when so divided, to the action of water, so as to remove all dust from the gas. *Patent completed.*

1742. R. Hornsby, Jun. *Improvements in thrashing machines.* Dated July 9, 1861.

Here the patentee connects the cranks at the further end of the shaker to the bars or boxes by connecting rods, and he drives the crank axes at different speeds, usually by a band and pulleys. When this arrangement is made the action of the bars at the entrance of the shaker where th straw is first thrown upon it is precisely as heretofore, bu at the further end of the shaker it is only occasionally tha the motion of bars is suitable for carrying the straw forward that is to say, it is only from time to time that the forwar motion of the bars or boxes takes place when they ar raised; from this cause the strain is retained on the shaker which consequently may be made shorter than heretofore *Patent completed.*

1743. J. German and G. N. Browne. *Improvements in apparatus to be used in shampooing.* Dated July 9, 1861.

This consists in combining a series of rollers which are preferred to be as near as may be of a spherical form, suitably mounted in a holder or frame, so that, when the holder or frame is passed over and pressed towards the parts of the body or limb of a patient, the rollers may indent and roll over, and offer friction to the parts with which they are in contact, thus producing a kneading of every part of the surface of the patient over which the apparatus or rubber is passed, whilst at the same time the skin of the patient will not be liable to be injured or broken. *Patent completed.*

1744. J. T. Chalinoworth and J. Thurlow. *Improvements in traction engines.* Dated July 10, 1861.

Here, in constructing framing for a traction engine, sheets of iron are used of great depth as compared with their thickness, and excepting at the fore end, such framing consists of four parallel lines of plates, producing three spaces between them. In the central space the boiler is received, and in the side spaces are the driving wheels, each having inner and outer bearings, both the bearings being fitted with springs. In the side spaces also, the steam cylinders are fixed in an inclined position, additional inclined side framing being affixed to receive them, and such inclined frames are affixed at their back and upper ends to the raising horns, which rise above the descending horns, which receive the box or bearings of the axle of the hinder wheels. Between the side framings which bound the central space above mentioned, the boiler is placed, and it is suspended by suitable trunnions or axes. The fore carriage of the traction engine is supported on two wheels, the locking apparatus of which is facilitated in its working by means of three or more wheels, or radial axes, such wheels being placed between the upper disc or plate, and the lower disc or plate of the locking apparatus. *Patent completed.*

1745. W. Cooke. *A wind guard for curing smoky chimneys.* Dated July 11, 1861.

Here the inventor constructs a cylinder or shaft, of perpendicular or other form, of iron, zinc, or other material, open at the top, so as to permit the smoke to freely ascend through inner cylinders of perpendicular, or it may be irregular, shape, at the same time preventing the outer current of air from ascending into the chimney-shaft by reason of certain openings in the outer cylinder which permit the air to go out at the sides. *Patent abandoned.*

1746. G. Weston and J. Weston. *Improvements in rotary steam-engines and pumps.* Dated July 11, 1861.

We cannot here devote space to the details of this invention. *Patent abandoned.*

1747. P. Adie. *Improvements in means or machinery for preventing damage in railway accidents.* Dated July 11, 1861.

This relates to the application of checks to railway carriage buffers, whereby the recoil is prevented from taking place in cases of collision, and strengthening the springs so as to lessen the effects of such collision. It also relates to the introduction of very strong plates or springs, supported all round or at both ends, which the buffers strike against in cases of collision. The inventor also applies the friction of a screw or saddle on the buffer-rod to release it gradually. *Patent abandoned.*

1748. J. Kidd. *Improvements in the manufacture, application, and combustion of gases, and in apparatus connected therewith.* Dated July 11, 1861.

This invention is carried into effect in the following manner :—From the centre of the interior of a gas holder dipping into a tank or well in the usual way, the inventor suspends a piece of zinc, iron, or other proper material. The tank is partly filled with acid or other proper liquid. As the gas is generated by the action of the acid or liquor on the suspended zinc, iron, or other material, it rises through the acid or liquor, and, forces the holder upwards. Proper means are used for permitting the escape of gas for use. If the gas is generated quicker than it escapes out of the holder, its pressure forces the holder to rise higher out of the tank, thus lifting the suspended zinc, iron, or other material out of the acid or liquor, and, thereby, stopping the generation of the gas till sufficient gas has escaped to allow the holder to fall, and the suspended zinc, iron, or other material to again come in contact with the acid or liquor. The gas thus generated is carburetted, when required, by bringing it, by proper means, into contact near the point of combustion with the vapour of naphtha or benzole. *Patent abandoned.*

1749. J. C. B. Salt. *A new or improved manufacture of street plates, name plates, and other plates or surfaces having inscriptions or devices thereon.* Dated July 11, 1861.

This consists in making the plates or surfaces by first coating or covering with enamel plates or surfaces of cast or wrought iron or steel, and fusing the said enamel thereon, so as to form an enamel ground on the said plates or surfaces, and afterwards applying to, and fusing upon, the said enamel ground the inscriptions or devices being made or produced in an enamel of a different colour from, and more fusible than, that of the enamel ground. *Patent completed.*

1750. J. Parson. *Improvements in apparatus and fittings connected with steam-engines and boilers.* Dated July 11, 1861.

This consists, 1, in improved modes of operating upon the throttle-valve for efficiently regulating the speed of the engine, and also for working the slide or tappet valves of the expansion apparatus for regulating the working expansively. 2. In a mode of lubricating steam-engine cylinders. 3. In an improved water-gauge for steam boilers. The invention is not described apart from the drawings. *Patent completed.*

1751. J. R. Cotter. *Certain improvements in the pianoforte.* Dated July 11, 1861.

The principal feature of this invention consists in eliciting or producing the tone from the central point or part of the strings throughout the whole range of the instrument, instead of eliciting the same from a point nearer to one end of the string than to the centre. The patentee attaches to the ordinary mechanism of the pianoforte (at the middle and upper part of the scales) "claws" or "fingers," so arranged and constructed as to strike past the string and retire (again past the string) without touching the same. *Patent completed.*

1752. T. Reeves, jun. *Improvements in apparatus for applying salt or other material to the roots of weeds.* Dated July 11, 1861.

For these purposes an instrument is used, by preference a hollow cutter, suitable for being forced into the earth, and to cut or bruise the roots of weeds; and in connection with the said instrument is a hopper, and two valves suitably arranged for discharging the salt to the roots of the weeds to be destroyed. *Patent completed.*

1753. W. Wilkinson. *Improvements in manufacturing and ornamenting brushes, parts of which are applicable to ornamenting baskets and articles of furniture, and in protecting silver or glass.* Dated July 11, 1861.

The primary object of this invention is the ornamentation of brushes, and the invention is carried into effect in the following manner :—The patentee takes two flat surfaces of, say wood, and coats each with glue or other adhesive material, and presses the two together until they are firmly united, and further secures the same, if necessary, with rivets or otherwise. When the back of the brush is made in the manner before described, he prepares it to receive the ornament by brushing a cement over it composed chiefly of glue or other adhesive substances. He then takes a piece of waterproof cloth or other fabric, and coats it with a similar adhesive substance, and lays it on the back of the brush, where it is caused to adhere by pressure or otherwise; the superfluous matter is then cut off, and the edges with the other parts of the brush are stained or ornamented to correspond with, or form a contrast to the back. The cloth he prefers to employ for this purpose is made from a pulp composed of cotton warp, hemp, wool, or other filamentous material. *Patent abandoned.*

1754. T. G. Messenger. *Improvements in the construction of valves.* Dated July 11, 1861.

This consists, 1, in forming a chamber with a valve seat and valve constructed of brass, or other material, the valve opening quite back so as to give the same capacity in the valve as that which is in the pipe with which it is connected. 2. In constructing a spindle working through a stuffing-box, or inside the chamber before-mentioned, to which spindle the above valve is attached, and which said spindle forms the hinge of the valve; a toothed quadrant is fixed to the said spindle, and is acted upon by a worm or screw, and wheel, or by a handle, or other contrivance, so that the operator may be enabled to open the valve any required distance. 3. In constructing a lid or door which may be removed with ease and at pleasure (should the valve require cleaning or repairing) without disturbing the pipes or breaking a joint. *Patent completed.*

1755. H. Ashwell. *Improvements in apparatus for washing, cleansing, scouring, getting up, dyeing, boiling, and steaming.* Date July 11, 1861.

This apparatus consists of a suitably-shaped trough, which trough is placed in another apparatus or case, which is bolted to the floor. To the sides of this trough inside are placed two or more pairs of vertical guides, and on the outside thereof are similar guides. In these guides rods slide, and these rods are made of wood, or other suitable material, and are connected to a cross head extending across the trough. To the centre of the cross head one end of a lever is secured by a pin and hinge, and the other end of the lever is connected to a rocking lever which is moved by another lever, and driven by being connected to a rod moved by an eccentric on a shaft actuated by steam or other power. Nearly over the centre of the trough, lying by the side of the cross head, is a perforated metal pipe, through which hot or cold water is distributed in a shower over the whole of the top of the cage. The bottom of the trough if also provided with a pipe and stop-cock, through which steam is admitted; similar pipes and stop cocks are provided for supplying other liquids. *Patent completed.*

1756. T. J. Smith. *Improvements in photographic albums.* Dated July 12, 1861

This consists in the manufacture of the leaves of such albums of parchment, vellum, textile fabric, or paper mounted upon textile fabric, such materials being more durable and less liable to be torn by the removal or insertion of photographic pictures than the paper hitherto used. *Patent completed.*

1757. W. B. Adams. *Improvements in locomotive engines, trains, and their rails, parts thereof applicable to fixed engines.* Dated July 12, 1861.

This invention, the specification of which is exceedingly elaborate, will probably be described in a future number of this journal. *Patent completed.*

1758. J. Adams. *Improvements in revolving fire-arms, and in cartridges for the same.* Dated July 12, 1861.

This relates, principally, to that class of revolving fire-arms, wherein a cylinder or series of revolving chambers, containing separate charges is used, each chamber being brought in succession opposite to a fixed barrel to be discharged. The first part consists in forming the barrel and the frame or opening in which the chambers rotate from one piece of metal, but in place of forming the frame and barrel as heretofore in one piece, suitable for being attached to the stock of the fire-arm, the patentee forms it in two parts. The part of the frame which carries the rotating chambers is firmly connected to that part of the frame which carries the lock and hammer, and which is attached to the stock of the fire-arm, by which arrangement the construction of the parts is greatly simplified. The second part of the invention consists in constructing the series of revolving chambers in combination with a revolving breech-piece or base-plate, so that such chambers may be suitable for receiving and exploding the charges contained in cases or cartridges, somewhat similar to the cases or cartridges, denominated "Lefancheuse cartridges." Apparatus is also arranged for forcing out the empty cases when exploded, and forcing in the charge when the cylinder is loaded at the muzzle. The improvements in cartridges for revolving fire-arms, such as before described, consists in forming them with a percussion cap and an exploding pin, placed in the base or back end of the cartridge, in place of introducing the pin through the side of the cartridge, as heretofore. *Patent completed.*

1759. S. Brachtold. *Improvements in perpetual calendars to be used, either separately or in connection with watches or clocks.* Dated July 12, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

1761. P. J. de Rette. *Improvements in wind instruments of music in brass or other metal by perforating their mechanism.* Dated July 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1762. C. Maschwitz, jun. *Improvements in taps or stop-cocks for liquids, steam, and gas.* (A communication.) Dated July 13, 1861.

The body of this stop-cock has an opening on its underside, in which a tubular piece is screwed, on the top of which is a conical valve seat. A conical valve fits the said valve-seat accurately. The spindle of the valve works in a guide near the top of the said tubular piece. On the said tubular piece is a tubular case, the lower contracted end of which constitutes the exit pipe of the tap. The lower end of the valve spindle is fixed to a cross piece on the said exit pipe, and by sliding the exit pipe upwards upon the tubular piece, the valve is raised from its seat, and the water-way of the tap is opened, and by sliding the exit pipe downwards, the valve is brought down upon its seat, and the water-way closed. On opposite sides of the tubular piece a pin or projection is fixed, and the said pins engage in vertical slots in the exit pipe. At the top and bottom of the said vertical slots horizontal slots are made, into which the pins or projections on the tubular piece may be made to enter by turning the exit pipe, when it is in its highest or lowest position. The top is thus fixed in its open or closed state. *Patent completed.*

1763. I. Beamish, and N. Beamish. *Improvements in lubricating those parts of steam engines acted on by the steam, and in apparatus for the same, which said apparatus can be used for other purposes.* Dated July 13, 1861.

Here the inventors force the lubricating material in small quantities amongst the steam, by preference into the steam pipe near the valve, or into the valve box, and allow it to be carried forward to lubricate the various parts of the engine impinged on by the steam, more especially the valve and cylinders. *Patent abandoned.*

1764. J. Pickering, H. Pickering, and N. Pickering. *Improvements in self-acting mules for spinning cotton and other fibrous materials.* Dated July 13, 1861.

This relates to that class of mules generally called Sharp and Roberts', and consists of certain improvements for regulating the speed of the spindles, so as to maintain the threads in a proper tension when winding on. The chain or band which operates upon the bevil wheel connected with the screw of the quadrant, is put in motion by causing a lever to come in contact with clicks or catches on the pulley connected with the aforesaid chain or band. The pulley turns loose upon its shaft, and when not in contact with the clicks no action or effect takes place; but when the lever is in contact with the clicks, the chain or band is moved, and acts upon the bevil wheels and screw. The lever is put in motion by a chain, one end of which is connected to the under faller bracket, and the other linked to a small shaft on the other faller bracket. To the shaft is fixed a ratchet wheel, which is moved one or more teeth by a catch when the faller descends to a certain point, which movement of the ratchet wheel turns the small shaft, and tightens the chain to the exact length required, and prevents the necessity for the operative to adjust the nut or screw of the quadrant. *Patent abandoned.*

1765. L. George. *A mode of soldering together two or more printing type letters to facilitate the work of the compositor, and arranging the type cases for same, which may be called English breviotypy.* Dated July 13, 1861.

The letters are soldered by the following composition, which is used cold :—two-thirds of mercury, and one-third of pure tin mixed well together. This solder is put on a plate of lead, and the broad side of the type rubbed thereon, and the composition is afterwards done as usual. The solder becoming quite rigid at or about the expiration of half an hour. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Sept. 14, 1861.

2298. T. Morris, R. Weare, and E. H. C. Monckton, Trafalgar-square. Improvements in batteries for obtaining electric currents and the products therefrom.

Dated Sept. 18, 1861.

2324. J. G. Briggs, 23 Earl-street, Blackfriars. An improved method of making fire-proof buildings, ships, and other constructions.

Dated Sept. 30, 1861,

2431. T. Smith, Aberdeen-street, Sheffield, optician. Improvements in the construction of umbrellas, adapted to purposes of self-defence, some of which improvements are also applicable to other purposes.

Dated Oct. 23, 1861.

2643. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane. Improvements in processes or means employed for separating or extracting silver from lead. (A Communication.)

Dated Nov. 2, 1861.

2763. T. Spencer, Prescot, Lancaster, earthenware manufacturer, and T. Robinson, St. Helen's, engineer. Improvements in machinery or apparatus for making pipes and other articles of earthenware, and in the form of pipes, for gas, sewage, and other purposes. (Partly a communication.)

Dated Dec. 12, 1861.

3113. W. Lightfoot, Harwell, Berkshire, surgeon. An improved bridle.

Dated Dec. 18, 1861.

3175. C. E. Symonds, 56 Stone's-end, Southwark, oil and colour merchant. Improvements in the treatment and application to various useful purposes of light spirituous liquids.

3177. J. M. H. A. Tanrines, Paris, constructor. Improved modes of constructing balances, weigh bridges, and other weighing machines.

Dated Dec. 19, 1861.

3183. E. Stott, Ashton-under-Lyne, machinist. Improvements in apparatus used for collecting and removing the waste and dirt which occurs in the process of spinning cotton and other fibrous materials.

Dated Dec. 20, 1861.

3203. D. C. Le Souef, Twickenham, Middlesex. An improvement in cylinders used in printing calicoes and other textile fabrics. (A communication.)

Dated Dec. 21, 1861.

3207. F. Grimaldi, 13 Manchester-buildings, Parliament-street. Improvements in rotatory steam boilers.

Dated Dec. 26, 1861.

3229. J. Jones, Liverpool, lead merchant. Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like nature, fusible at a low temperature into sheets of any thickness or length, and in the apparatus connected therewith.

3231. L. J. Taulin, musical instrument manufacturer, 2 Rue Ste. Appoline, Paris. An improved wind musical instrument.

Dated Dec. 30, 1861.

3255. J. Gorton, Park House, Gateshead, manufacturer, and B. Henderson, South Shore, Gateshead, engineer. Improvements in the manufacture of ropes.

Dated Dec. 31, 1861.

3264. N. McHaffie, 16 Summer-street, Mile-end, Glasgow. Improvements in ventilators or valves for regulating the passage of air or other fluids, whether of a gaseous or liquid form.

3275. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in revivifying animal black or charcoal, in collecting ammoniacal gases generated in the revivification, in the clarification of saccharine liquors, and in apparatus employed in the revivification of the black, and in the filtering of saccharine liquors. (A communication.)

3276. A. E. Edward and J. Edward, Dundee, spinners. Improvements in machinery or apparatus for spinning fibrous materials.

Dated Jan. 1, 1862.

2. N. C. Szerelmey, 6 Park-terrace, Brixton, gentleman. Improvements in the manufacture of leather cloth or imitation leather, and in rendering certain fabrics waterproof.

4. T. Hall, Odiham Wharf, Odiham, Hants. An improved apparatus for removing weeds from canals, rivers, and lakes, after such weeds have been cut with a chain, scythe, or other machine or implement applicable to that purpose.

Dated Jan. 2, 1862.

20. W. A. Fell, Troutbeck-bridge, Windermere, machine maker. Improvements in the manufacture of bobbins and in the means or apparatus employed therein.

Dated Jan. 4, 1862.

28. J. W. Arundell, 265 Gresham House, Old Broad-street, gentleman. An improved method and improved apparatus for treating and dressing ores and minerals, particularly applicable to tin, lead, copper, zinc, and iron ores. (A communication.)

30. J. W. Arundell, 265, Gresham House, Old Broad-street, gentleman, An improved method of, and apparatus for, communicating motion to fan ventilators, particularly applicable to ventilating mines. (A communication.)

32. R. H. Cotter, Cambridge Heath, Middlesex. An improved apparatus for instantaneously lighting certain lamps, and, when desired, extinguishing the same.

Dated Jan. 6, 1862.

38. J. Coryton, Rolls Chambers, 89 Chancery-lane, barrister at law. An improved type machine.

42. W. T. Kite, Mongewell Mill, Wallingford, Berks. Improvements in the manufacture of starch and in apparatus employed therein.

Dated Jan. 8, 1862.

52. S. Jesson, Smethwick, Stafford, roller, J. Batson, the younger, Smethwick, iron and coal master, J. Moore, the younger, Langley, near Oldbury, Worcester, roll turner, and J. Roberts, Smethwick, manager of works. Improvements in the manufacture of gun barrels and wrought iron tubing.

54. J. Barber, Preston, Lancaster, manager. Improvements in band mules, consisting of a break and backing-off motion.

56. H. Bessemer, Queen-street-place, New Cannon-street, London. Improvements in the machinery and apparatus employed in the manufacture of malleable iron and steel.

Dated Jan. 9, 1862.

60. J. Smith and S. Wellstood, Glasgow, stove and range manufacturers. Improvements in cooking stoves or ranges.

62. T. A. Weston, Birmingham, mechanical engineer. A new or improved multiplying gearing for transmitting and multiplying power, which said gearing may be applied to cranes, windlasses, capstans, and presses, and to other purposes where it is required to transmit and multiply power.

64. H. Charvet, Lille, France, manufacturer. Improvements in the spinning of cotton and in its various applications.

Dated Jan. 10, 1862.

80. W. Clark, 53 Chancery-lane, Middlesex, engineer. Improvements in apparatus for generating and applying steam as a motive power. (A communication.)

Dated Jan. 11, 1862.

82. H. Charlton, Birmingham, merchant and manufacturer. Improvements in the manufacture of certain kinds of shoes for mules and horses.

Dated Jan. 13, 1862.

90. F. C. Warlich, 10 Alma-terrace, New-cross, Kent, gentleman. Improvements in the manufacture of artificial fuel.

92. J. Parker, Ivy House, Bradford, York, J. Wells and B. Wells, Bowling, near Bradford, millwrights. Improvements in steam engines, boilers, furnaces, and apparatus in connection therewith or applicable thereto.

94. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in the manufacture of cups, bowls, saucers, and other dished articles and cases. (A communication.)

96. G. Hewitt, Ipswich, surveyor. Improvements in apparatus used in the manufacture of drain tiles.

100. C. N. May, Devizes, Wilts, engineer. Improvements in the manufacture of pastry, and in apparatus for the same.

Dated Jan. 14, 1862.

106. W. Gorse, Minworth, Warwick, manufacturer. An improvement or improvements in machinery for manufacturing the cut nails called brads.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

162. W. Toner, Gracechurch-street, and A. Read, Walworth. Improvements in boots and shoes. Dated Jan. 21, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2298. T. Morris, R. Weare, and E. H. C. Monckton. Batteries.
2303. J. Reeves. Electric magnetic engines.
2312. F. M. and E. L. Ransome. Treating stone filters.
2315. F. Wrigley. Securing armour.
2317. J. Eastwood and J. B. Joyce. Combing fibrous substances.
2321. J. G. Briggs. Fire-proof buildings.
2331. E. Suckow and E. Habel. Fibrous materials.
2338. L. G. A. Condroy. Centrifugal apparatus.
2340. W. Clark. Nets. (A communication.)
2348. T. Redwood. Manufacture of paper.
2353. J. C. Davidson. Thrashing machines.
2359. F. W. Wymer. Sounding the holds of vessels.
2362. C. Board. Veneering presses.
2363. H. and F. C. Cocker. Manufacture of gas.
2364. J. Fenton. Causing the water to circulate in steam boilers.
2365. W. Stableford. Manufacture of wheels.
2371. H. Planteon. Washing and scouring tools.
2375. A. A. Hely. Fire-arms.
2382. T. Davey. Safety fuses.
2384. J. Fawcett. Cleansing and fulling woollen cloths.
2387. J. Banks. Electro-magnetic printing apparatus.
2390. T. Bright and R. Mills. Printing yarns.
2392. R. A. Brooman. Letting off water and admitting oil or other lubricating matter into steam cylinders. (A communication.)
2398. G. Russell. Bedsteads.
2402. J. Openshaw, W. Entwistle, and J. Lord. Spinning.
2416. J. Kimberley. Grooving wood.
2417. D. Mc Callum. Filling and closing bottles.
2426. D. Lane. Regulating the passage or flow of fluids.
2431. T. Smith. Umbrellas.
2440. F. Walton and R. Beard, jun. Varnishes.
2441. G. O. Lesourd. Joining pipes and tubes. (A communication.)
2495. W. Clark. Gas regulator. (A communication.)
2511. S. Bremner. Printing machines.
2536. W. E. Newton. Heating the feed water of steam engines. (A communication.)
2542. T. B. Collingwood and A. Butterworth. Spinning and doubling.
2543. W. E. Newton. Condensing apparatus. (A communication.)
2569. W. E. Newton. Condensing apparatus. (A communication.)
2638. F. O. Ward. Hydraulic presses.
2696. B. Predavalle. Hydro-pneumatic motive power.
2912. J. H. Johnson. Cutting irregular and curvilinear forms. (A communication.)
2959. J. H. Johnson. Picture frames. (A communication.)
2965. A. W. Willis. Pencil cases.
3012. R. C. Perry. Feeding bottle.
3096. T. Higgins. Filling dipping clamps with tapers, match stems, and splints.
3114. W. W. Godfrey. Fastener for Albert guards.
3172. M. Hanff. Boxes and cases.
3188. J. Smith and J. B. Higgs. Mills for grinding.
3259. A. I. Austen. Night lights.
3275. R. A. Brooman. Revivifying animal black or charcoal. (A communication.)
51. A. Heath. Inkstands.
60. J. Smith and S. Wellstood. Cooking stoves.
80. W. Clark. Applying steam as a motive power. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Jan. 24, 1862.

1877. W. Wigfall.
1885. J. Robertson.
1887. G. Sturrock.
1890. R. Riley.
1891. W. Melrose.
1892. C. J. Guffroy.
1893. W. L. Scott.
1897. T. Bradford.
1898. W. H. Ash.
1902. J. M. Hart.
1906. J. T. Flanders.
1914. E. J. Muggridge.
1927. G. F. Jones and J. Jones.
1931. J. Henderson Broadley.
1983. E. T. Hughes.
1988. C. Lee and T. Mace.
1991. A. P. B. Felgas.
1992. G. H. Bristal.
2025. T. Silvester.
2758. B. Brown.
2823. A. Turner.
2831. G. F. Wilson Payne.

Sealed Jan. 28, 1862.

1912. H. Shaw.
1919. R. Benton.
1926. J. Cross.
1929. G. L. M. Viscount de P. d'Amecourt.
1933. J. Vavasseur.
1939. H. C. Meyer.
1941. E. D. Johnson.
1962. N. A. Lesueur.
1969. N. D. P. Maillard.
1973. W. S. Hogg.
1975. G. H. Bovill.
1979. H. Kinsey.
1983. J. Hemingway.
2001. A. Garzend.
2002. W. E. Gedge.
2039. J. Combe.
2076. G. F. Muntz.
2180. W. Fox.
2941. S. Sansum.
2953. J. Macintosh.

PATENTS ON WHICH THE THIRD YEAR'S ST DUTY HAS BEEN PAID.

193. J. Childs.
201. D. Moseley.
206. T. W. Rammell.
207. C. Sharpe.
216. J. Fowler, R. Burton, D. Greig, and J. Head.
222. H. Owen.
236. I. Hammond.
238. D. Graham.
242. J. Kerr.
249. H. Rawson.
252. G. F. Bradbury J. J. King.
258. C. E. Amos Francis.
262. H. Watson.
266. J. MacKenzie.
285. J. Lane.
291. M. Loam.
372. W. E. Newton.
443. H. Y. D. Scott.

PATENTS ON WHICH THE SEVENTH YEA STAMP DUTY HAS BEEN PAID.

181. C. W. Tupper.
236. G. Price.
301. G. F. Wilson Payne.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Jan. 25, 1862

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d
1502	0 7	1509	0 3	1516	0 3	1523	0 6	1530	0 [illegible]
1503	0 11	1510	0 4	1517	0 3	1524	0 9	1531	1 1
1504	0 5	1511	0 11	1518	0 10	1525	2 3	1532	0 6
1505	0 10	1512	0 10	1519	0 7	1526	0 6	1533	1 4
1506	0 8	1513	0 3	1520	1 4	1527	0 8	1534	0 10
1507	0 3	1514	0 3	1521	0 10	1528	0 10	1535	0 9
1508	0 3	1515	0 3	1522	0 6	1529	0 3	1536	0 [illegible]

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Jan. 30, 1862.

		£	s.	d.		£	s.	d.
IRON:								
Rails in Wales and North of England	pr. ton	6	5	0	to	6	[illegible]	[illegible]
Welsh Bars, in Wales		6	5	0		[illegible]	[illegible]	[illegible]
Staf. Bars, at the Works	"	6	10	0	"	7	[illegible]	[illegible]
" Hoops	"	7	10	0	"	[illegible]	[illegible]	[illegible]
" Sheets, Singles	"	8	0	0	"	[illegible]	[illegible]	[illegible]
" Nail Rods	"	6	15	0	"	6	10	[illegible]
" Boiler Plates	"	8	0	0	"	[illegible]	[illegible]	[illegible]
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2	7	0	"	2	15	6
Do. No. 1, Good Brands	"	2	8	0	"	2	10	[illegible]
Scotch Bars	"	7	5	0	"	7	15	[illegible]
Swedish Bars, in London	"	10	10	0	"	11	[illegible]	[illegible]
COPPER:								
Sheet and Sheathing	per lb.	0	0	11	"	0	0	0
Tough Cake and Tile	pr. ton	98	0	0	"	0	0	0
Best Selected	"	101	0	0	"	0	0	0
Australian	"	102	0	0	"	0	0	0
South American	"	0	0	0	"	0	0	0
Yellow Metal Sheathing	per lb.	0	0	9½	"	0	0	0
STEEL:								
Swedish Keg	pr. ton	15	0	0	"	0	0	0
" Faggot	"	16	0	0	"	0	0	0
TIN:								
English, Block	p. cwt.	6	1	0	"	0	0	0
" Bar	"	6	2	0	"	0	0	0
Foreign, Banca	"	6	3	0	"	0	0	0
" Straits	"	0	0	0	"	0	0	0
TINPLATES:								
Charcoal, I.C.	pr. box	1	7	0	"	1	9	0
Coke, I.C.	"	1	1	6	"	1	0	0
LEAD:								
Pig, English	pr. ton	19	10	0	"	20	0	0
" Spanish	"	19	0	0	"	19	10	0
Common Sheet	"	21	10	0		22	0	0
Tea " (Wimshurst's Patent) A special discount	"	35	0	0	"	0	0	0
SPELTER:								
On the spot	"	18	5	0	"	0	0	0
For arrival	"	18	10	0	"	0	0	0
ZINC:								
English Sheet	"	26	0	0	"	0	0	0
QUICKSILVER	pr. btl.	7	0	0	"	0	0	0

JAMES LAURIE, Metal Brok
10 Old Jewry Chambers E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 7, 1862.

THE HARTLEY CATASTROPHE.

The Rev. Sidney Smith said that we should continue to have railway accidents arising from carelessness until a bishop was killed, and then railway directors would awake to a sense of their duty. Though no bishop or coal proprietor has been killed in a coal mine, it is very probable, in fact pretty certain, that the Hartley catastrophe will be the means of diminishing the liability to accidents in such places in future. The catastrophe has so burnt itself into the heart of the British people, that it will be impossible that many mines should remain in their present anomalous condition. It is not likely that another cast-iron beam will be manufactured, and no doubt some effective means will be suggested and adopted for strengthening those which do exist. It is also likely that some precaution will be taken to prevent beams falling into shafts, provided they should break. This may be done by bearers being put across the shaft a few feet below the nose of the beam. Beams have broken before, and particularly in Devon and Cornwall, without accident, because such common-sense precautions had been taken. Mr. Thomas Ennor, in a letter to a contemporary, states that a few months since the main beam of an engine which he erected, broke, but it did not, because it could not, fall into the shaft, as the necessary means had been taken to prevent such a disaster.

It has been supposed by northern coal-owners that by having only one shaft, expense was thereby economised. This has been proved to be an incorrect supposition. When a shaft, say twelve feet square, is sunk, the area has to be divided into two or three shafts by brattice work. To make this work perfectly air-tight is a costly operation. It has been said, by good authority, that the cost of labour and material for this work would more than pay for an additional shaft. When the cost of keeping the bratticing work in repair is considered it would no doubt be more economical to have two shafts. The cost of keeping a brick-cased shaft in repair is comparatively trifling. Mr. George Sheppard, M.E., says that some of the brick-cased shafts of Shropshire were sunk sixty or seventy years ago, and are now as good as when first sunk. Had they been cased with timber, they would have collapsed long since. When there is only one shaft with the brattice system, should an explosion take place, the brattices are the first to give way, and then the air course is destroyed, ventilation ceases, and the poor sufferers, who may escape the fire, fall victims to the carbonic acid gas generated during the explosion. The necessary ventilation has closed, the dead are left for days, on some occasions before the brattices can be repaired, in order to explore the mine, an operation which sometimes costs thousands of pounds, or perhaps twice the cost of sinking an additional shaft. The more this one-shaft system is inquired into, the more injudicious, uneconomical, and blameworthy it appears. The wonder is that proprietors have not obeyed the behests of common sense and the warning of authoritative voices before. It will be seen now whether they will act wisely, or wait till the Legislature compels them to do what reason and humanity suggest. It is next to impossible for things to remain as they are at present.

Mr. Joseph Godwin, in an able letter published in the *Mining Journal*, goes into particulars to prove the economic advantages of more than one shaft. The second shaft can be sunk more cheaply than the first, inasmuch as the second could be drained by the first sinking. The cost of sinking two circular shafts, he says, each 11 feet in diameter (and walling them with 9 inch brickwork and hydraulic lime), through strata of an ordinary character, with an angle of inclination not exceeding 20°, nor the water exceeding a hundred gallons per hour, in a locality where coals are moderately cheap, need not exceed £7 10s. per lineal yard, every thing included. It would, therefore, not cost more than £1,500 to sink a shaft 2,000 yards deep, a small sum compared to the many advantages and the much greater security enjoyed when more than one shaft exists. "The disadvantages of the system under consideration," says Mr. Sheppard, "are both numerous and highly objectionable: a colliery with one shaft is placed in the same relation to a colliery with two as a man with only one arm is to another with the use of both, so far as the raising of coal to the bank goes. Granting that the machinery is adapted for raising a load up one shaft whilst the empties are descending the other, little more than half the quantity of coal could be raised in the same time as in two shafts, each having two separate ropes, the one descending whilst the other is ascending. A further and powerful objection applies to the principle of having only one rope in each division of the shaft —that of the load in its descent checking the current of air in the upcast, and *vice versa* for the downcast. I have perceived the current of air to be momentarily suspended on different occasions when this system has been employed at a distance of more than 1,000 yards to the shaft. Two disastrous explosions at one colliery, launching nearly 200 human beings into eternity, and occurring within 11 months of each other, are clearly traceable to this cause. The same objection does not apply to one shaft, whether used for upcast or downcast, providing one rope is ascending whilst the other is descending. Another objection is that of having to suspend all operations during the time any repairs are being made to the pumps, or the changing of buckets, clacks, &c. This is an objection that must be very annoying when a brisk trade demands that every moment during working hours shall be devoted to raising coals to bank. With this objection may be coupled that of the liability of any of the machinery connected with the winding of coal to break or become deranged, or even the guide-rods: in such cases the whole of the operations are not only suspended, but the men are imprisoned in the mine until such repairs are made, or have to be drawn out of the mine by some slow and tedious process."

There are significant indications that parliamentary action will be taken on this question. A petition is now being signed by the miners of Northumberland and Durham, praying the Legislature to inquire into the present system of ventilating and working mines, with a view to the better protection of miners from the appalling disasters which are perpetually occurring. The petitioners say that they have arrived at the inevitable conclusion, from sad experience among their class, that every mine, previous to working coal, should have two distinct shafts, one at the dip, and another at the rise. That the Government will comply with this petition, and act in obedience to the demands of public opinion, is evident. The Secretary of State has requested each inspector to transmit to him a return, showing the number of single brattice shafts in his district, with their depth, diameter, and the mode in which they are sub-divided, and also the number of collieries with more than one shaft, and to state in each case whether ventilating furnaces are used below ground. The inspector is also called to state his opinion as to the practicability of requiring that in all large collieries there should be more than one shaft. The whole question is, therefore, likely to be amply discussed, and we shall await the opinions expressed in Parliament, and the returns of the inspectors, with some anxiety.

We cannot conclude our remarks this week on the Hartley catastrophe, without saying a word in favour of the men who imperilled their lives, amid danger and discomfort, to rescue their fellow-men from destruction. They worked on day after day, and night after night, regardless of themselves, with no hope of reward, or expectation of applause. The descent of falling stones and earth, and the ascent of poisonous vapours, did not deter them for a moment in the performance of their duty. England, which lavishes her honours and acclamations on her soldiers and sailors, when performing their duty, in storming bastions, sacking cities, and destroying human life, ought not, and will not, be unmindful of those brave men who heroically encountered danger to render succour to the perishing. We do not recommend that these men should be allowed to wear medals, but their names deserve eternal enshrinement in the memory of the country. They have taught a lesson which all may imitate with advantage, and they have given another proof of the undying courage which animates the true Englishman, whether he be plebeian or peer, when difficulties are to be surmounted, and human suffering to be assuaged.

CIVIL ENGINEERS AS SHIPBUILDERS.

A year or two ago we invited the attention of our readers to the astonishing interest in shipbuilding questions which the Civil Engineers at that time suddenly displayed at their Institution, in Great George Street, and which was the more remarkable from the circumstance that the Institution of Naval Architects had just then been organized, for the purpose of fostering that particular art. So far as we could then judge, it seemed to be the President, Mr. G. P. Bidder, to whom that singular and untimely outburst of regard for a previously neglected art was chiefly due; and the subsequent discussion which was opened by his son, under his own auspices, on a similar subject, gave further strength to the conjecture. But however that may have been, the Institution seemed to be quite disposed to follow Mr. Bidder's lead in the matter; and their new President, Mr. Hawkshaw, evidently framed his late inaugural speech to suit their feelings in this respect.

Whatever unseemliness some may discover in this new enthusiasm for a subject to which the Civil Engineers gave but very meagre consideration for so many years prior to the establishment of the new professional body, it is no part of our duty to complain, especially as we feel confident that the promoters of the Institution of Naval Architects have not the slightest desire to check what must appear to them both a gratifying and amusing rivalry. The "Transactions" already issued by the new Society, and the lists of Members and Associates of the Institution which they contain, show that its position is far too well assured to suffer from the spasmodic competition of older, but less strictly professional organizations. But although we have no complaints of this kind to make, it is not the less our duty to review the proceedings of the Civil Engineers in a scientific spirit, and to inquire how far they display knowledge and ability in dealing with this new-found department of study.

And in doing this, we must premise that the only people who can really improve our shipbuilding, and particularly our war shipbuilding, are those who are competent to step forth from the region of loose generalities, and grapple with the practical difficulties of the constructor's business as they arise. We do not want the Civil Engineers to embarrass the naval architect with a mass of vague suggestions and assertions, the reality and value of which vanish so soon as they are subjected to a scientific test. We have an abundance of people doing this already, and an increase of their numbers would only be a nuisance. We do not ask, of course, that the mere prejudices of our shipbuilders shall be respected; but we are bound to require that every amateur naval architect shall comply with the laws of science, or rather the laws of nature, and shall have something new to state, before he sets himself up as a teacher and an innovator.

Now, we are sorry to say that neither Mr. Bidder, nor his son, nor Mr. Hawkshaw, nor any other Civil Engineer, has yet contributed anything (during the discussions of the last year or two in Great George Street) beyond the most empirical statements and recommendations as regards our shipbuilding difficulties. Mr. Hawkshaw, in his address of the 14th inst.—to deal with the last speech first—never attempts to pass beyond this. What has he to tell us? That we are called upon "to build "the steamboats that bridge the seas"; that "the progress that has been made in steam "navigation in the last few years is truly remarkable," giving examples to illustrate the fact; that "great progress has also been made "in the application of the screw propeller to "steamships"; that "for vessels of war, and "other purposes," the screw "possesses advantages over the paddle"; that "the doubts "which prevailed until very lately, whether "iron was the best material for line-of-battle "ships, seem now nearly dispelled, although "the rapidity with which iron fouls will, unless "some remedy can be devised, always be a "source of trouble"; that "the precise and "best mode of constructing iron ships of war "is still an interesting problem"; that "there "seems to be no good reason why the upper "and lower decks, and every portion of the "hull of such [iron-cased] vessels, should not "be of iron"; that "greater strength would "be thereby attained"; that ships of war should be "constructed practically, as far as "possible, as if welded out of one piece of "iron"; that steamships "can be made "stronger, and yet made to steam faster, "than they yet have been"; and so forth. These are the kind of remarks with which the new President's speech abounds, and we cannot find in it anything more novel, more interesting, or more useful in respect of naval architecture. It is a mere string of commonplace observations, such as almost any one of the thousands of our constant readers could put together, probably, in a very few minutes. We know not what the Civil Engineers may think of such statements, but we feel perfectly sure hat no officer of the Institution of Naval hitects would ever think of addressing to that body, and if he did, no member body would ever waste his time in to them. We have to speak thus ith considerable regret, because as a r Mr. Hawkshaw is a very able man, and it is only when forced into a foreign subject, that he comes down to the level of such remarks as we have quoted.

If we turn to the paper of Mr. Bidder, jun., (which was delivered many months ago, but only appeared at length a few weeks since) we shall find that he also thought it modest and reasonable to propound some very general, indefinite, and valueless propositions, chiefly concerning the iron-cased ship question. There is really nothing new about any of them, except in such instances as where he tells us that henceforth our men-of-war must "lie as low in "the water as is consistent with *safety*," whereas their height must always be regulated, of course, by the necessity of fighting their guns efficiently in rough weather; and where he states that "a ram, to be effective, must be of greater "size and weight than the largest man-of-war "afloat!" The incompetence of the author to deal with a single detail of the subject to which he so rashly put his hand is manifested very remarkably in one place. He says:—"Some "of the principal objections to the use of iron "[for ships of war] are stated to be its liability "to splinter when struck by shot, and the difficulty of stopping the shot-holes, as also the "constant fouling of the bottoms of iron ships." Now, here he omits altogether to mention that local weakness of the bottoms of iron ships, which has had a greater effect than any other objection in inducing naval officers to stand out against their introduction; and even in respect of the three defects which he mentions, all he does is to show that one of them is less serious than formerly; on the other two, he has not a single word to say. There are, however, four great facts of which he seems to be pretty well convinced: he believes actions at sea will henceforth be fought at long range; he thinks we ought to build, for home defence only, a considerable fleet, incapable of service elsewhere; he considers that in ships like the Warrior their batteries should be carried upon the spar deck (one deck being dispensed with); and he contends that the spars and rigging of such ships should be of a very subordinate description. We might easily refute all these opinions in detail; but we must here content ourselves with saying that, in our judgment, actions with iron-cased ships will usually be fought muzzle to muzzle, or very nearly so; that it would be a most disastrous misuse of money to build fleets incapable of blockading an enemy's ports; that to expose the gunners of such ships as the Warrior upon a spar deck, without a cover to protect them from the enemy's rifles, would be sheer insanity; and that ample sailing powers must on no account be sacrificed until we have contrived to give perfect protection to our steam-driven propellers, and to carry far larger supplies of coal than any fighting ship in the navy yet possesses. We cannot stay to enlarge upon these points; readers must decide for themselves whether we are correct or not.

Mr. Bidder, sen., to whom we now come, is marvellously confident in his skill as a naval architect, and no less marvellously bold in his judgments upon gentlemen who belong to the shipbuilding profession. As a specimen of his virtues in these respects, we may mention that in one place he distinctly and emphatically pronounces the naval architects at Whitehall ignorant of their profession. "The designing "of the ships of the navy," he says, "is under "the control of those who are ignorant of the "art they profess to practice. If a man is "master of an art he ought to be able to tell "his employers what would be the result of "that which he is going to do. A naval "architect in designing a ship for the merchant "service, contrives to attain tolerably well the "object in view. But in the Royal Navy "there are instances of 15 feet being put on to "the bow, to ascertain what difference this "this would make between her and another "ship built upon the same lines, not for any "foreseen real practical benefit, but merely to "ascertain whether 15, 20, or 30 feet would "give the proper lines; as if this could only "be ascertained by a series of costly and "wasteful experiments." Now, such language as this, coming from the late President of the Institution of Civil Engineers, is very far from creditable, because it betrays a strong desire to damage several influential members of another profession, and affords no justification whatever for doing so. We are pretty well cognizant of the capabilities of the naval architects at Whitehall, and we know them to be among the very ablest men in the profession. Mr. Watts, the chief constructor, was trained from boyhood in the business; was a distinguished member of the School of Naval Architecture; served for many years as a practical shipbuilding officer in the Royal Dockyards with great credit; and has filled his present post with equal success. He is assisted by a staff of younger men, many of whom served apprenticeships as shipwrights in the dockyards; were afterwards trained for several years in the highest branches of their art; have since held responsible positions as shipwright officers; and have now had considerable experience in the construction department. Two of the Whitehall staff, Mr. Barnes and Mr. Barnaby, have contributed very valuable papers to a professional institution, and commanded the eulogiums of the ablest private shipbuilders. In the face of facts like these, we view with deep regret the imputation of incompetency which Mr. Bidder—who cannot be a competent judge—has been so thoughtless as to publish. And our regret is greatly increased when we consider the ground on which he bases so sweeping and serious a charge; for not only is it incapable of sustaining Mr. Bidder's statement, but it really is well calculated to support the credit of the persons complained of. In building ships of a similar class and form they sometimes, it appears, vary their lengths somewhat, in order to ascertain practically what is the exact effect of increased or diminished length upon the speed. Now this, we do not hesitate to say, is precisely what they should do, and what we are very glad to find them doing; because we shall thus have reliable light thrown upon a very abstruse point in naval architecture. We could ask for no better proof, in fact, of the thoughtfulness which they exercise than is thus afforded us. Mr. Bidder, however, can see nothing in all this but "costly and wasteful experiments"; and seeing only these, straightway denounces the whole affair, and everybody concerned. We are very sorry to see him act so foolishly. A metropolitan member of Parliament could have seen as much and said as much; but of the President of a scientific Institution more might have been expected. Nor can we congratulate him upon his philosophy when he tells us that a naval architect ought to know all about the resistance of ships, because "if a man is master "of an art, he ought to be able to tell his employers what will be the result of that which "he is going to do." There are some things in all arts which even the "masters" do not understand. We doubt if Mr. Bidder himself could tell the precise effect of every suggestion he has made in civil engineering, although such a doubt may never have occurred to his own mind. He may even have gone the length of committing an error or two; in fact, think it almost possible to prove that he has done so.

We wish Mr. Bidder had contented himself with imputing gross incompetence to the Admiralty naval architects. But this did not, unhappily, satisfy him. He seems to have thought a little moral, as well as professional, detraction desirable; and in this case the late Controller of the Navy served him as a victim. When Lord Clarence Paget earned his present post by that "tremendous header" which he took into the lake of fiction, bringing up with him that deficiency of £5,000,000 sterling which we all looked upon with astonishment, Sir Baldwin Walker thought it desirable to rebut the accusations brought against him, and published a paper (which appeared at the time in the Mechanics' Magazine) replying to Lord Paget's charges in detail. In that paper he showed that in eleven years, only one screw ship (the Howe) had been altered from her original design, and that she was only in frame when the alteration was made. "The actual "expense," he added, "of *taking down the "timbers, and retrimming and replacing them*, "was £384 5s. 3d." This sentence Mr. Bridder quotes, and to it he adds the following remark: "Speaking in the presence of practical men "who know pretty well the cost of altering "anything on board a ship, the supposition "that *a line-of-battle ship could be lengthened "15 feet* for the paltry sum of £384 5s. 3d. "was going too far"! Now, we ask if this is behaviour becoming a man in Mr. Bidder's position? Who will not grieve to see him thus construing the reconversion of a few frames into "the lengthening of a line-of-battle ship "15 feet," merely for the purpose of assailing a distinguished and absent man's character?

But Mr. Bidder's science is, after all, the most remarkable thing about him. In one place, after criticising the ships of the Royal Navy, he said, "Every one who has seen those "ships propelled through the water, must have "been struck *with the enormous power that is "wasted by displacement.*" Mr. Bidder surely does not know the meaning of the word "dis-"placement"! Or is he about to show us how to build ships without displacement? There have been many clever gentlemen proposing at different times to build us ships which should slide over the surface of the water, without displacing any of it; but we scarcely expected to hear the proposal repeated from the chair of the Institution of Civil Engineers! Shades of Locke and Stephenson, to what have you abandoned us!

ON FUEL.

Article III.—Peat and its Products.

Of the various kinds of natural fuel, peat is one of those most abundantly found in temperate climates, more especially in those which are moist and humid. In Ireland, the peat bogs constitute one-seventh of the whole area of the country, or about 2,800,000 acres. More than a half of the peat soil, or about 1,576,000 acres, is estimated to consist of flat red bog; the remaining 1,255,000 acres are called mountain bogs, being on the surface of the uplands. On the mountain sides peat seldom exceeds four feet in thickness; but in the lower grounds it sometimes is of a greater depth than that of forty feet.

Peat consists of the woody fibres of partially decayed marsh plants, chiefly grasses and mosses, which continue growing on the surface whilst the older plants are decaying below. Its aspect varies very greatly. At the surface it is light in colour, fibrous, elastic, and spongy, retaining in its texture a large quantity of water. At greater depth it becomes much darker in colour, is in a more advanced stage of decomposition, denser in structure, and containing a very greatly increased proportion of mineral matter, which is left as ash after combustion.

The composition of peat is very similar to that of wood. The specimens taken from different localities vary somewhat, but for practical purposes it may be regarded as consisting, when perfectly dry, of

Carbon	50 to 60 per cent.
Hydrogen	6 „
Oxygen	30 „
Nitrogen	2 „

Ash, or mineral matter, varying from 2 to 9 per cent.

The specific gravity of peat differs considerably in the different specimens. The lighter and more spongy varieties are sometimes as low as 0·25, the denser varying from 0·6 to 0·9.

The quantity of water that any given specimen of peat contains is of the greatest importance in a calorific point of view. The peat of commerce has been found by Sir Robert Kane to contain one-fourth of its weight, and after having been very carefully air-dried under shelter it still retains one-tenth of its weight, of water.

As the calorific power of peat is greatly diminished by the contained water, it is of the utmost importance to get rid of as much as possible. The usual arrangements for cutting, collecting, and preparing peat are very open to objection. It is not unfrequently cut at a wet season of the year, and is exposed to the rain during the whole time of drying, hence it can hardly be said to be dried at all. The effect of the contained water on its calorific power is easily illustrated. One pound of perfectly dry turf is capable of evolving sufficient heat during combustion to evaporate six pounds of water; but as a pound of ordinary commercial turf contains only three-quarters of a pound of dry turf, and a quarter of a pound of water, it cannot evaporate more than four and a-half pounds of water, and this amount is practically lessened by the circumstance that the contained quarter of a pound of water has to be first evaporated; hence turf containing one quarter of its weight of water has its heating or calorific power reduced more than 30 per cent.; and as the best air-dried turf still contains 10 per cent. of water, its calorific power is reduced 12 per cent., one pound of such turf being capable of evaporating only 5 1-3rd pounds of water.

Peat is usually cut out of the bog in right-angled blocks, which are stacked, and covered over with some of the surface turf, so that it may be air dried without exposure to rain. In some parts of Ireland, a plan is followed that appears to have suggested a process which has been patented. The turf as it is cut is thrown into a pit of water, and the labourers, stripped below the waist, trample it into a dense pulp; this is worked by hand into masses, which are dried and retained for use. Various methods have been proposed to improve the value of turf as fuel. One of the most promising was the removal of its porosity and too ready inflammability by compressing it into solid blocks; but it has been found in practice that the elasticity of the fibres presents almost insuperable objections to its profitable compression. Dr. Percy states that one of the most successful methods appears to be that of grinding the turf in a pug mill, and then moulding the pulp thus produced into bricks, which are first dried in the air, and afterwards in stoves. This method is in operation at some of the iron works in Sweden, and is substantially the same process as that patented by Linning, in 1837. The following extracts from the specification shew the nature of the process: "I, in the first place, reduce the "mosses to a homogeneous pulpy mass, nearly "in the same manner as brick makers reduce "their plastic materials to a uniform state, by "passing through a pug mill, but in which I "fit longer and sharper knives, somewhat "obliqued. . . . I then convey the moss, "as prepared, to a table, to be moulded like "bricks, either by the hand or by mechanical "means. The blocks or pieces are then "exposed to pressure by means of screws, "levers, or hydraulic presses, and arranged in "a close chamber or kiln, in order that they "may dry and consolidate. Exposure to an "artificial heat, from 70 to 120 Fahrenheit, for "twenty-four hours, will be sufficient to dry "the manufactured article completely, which "will then be in a dense and very hard state, "and may be used for the same purposes as "pit coal."

"In localities where good coal is abundant," says Dr. Percy, "and can be obtained at a "moderate price, it is hardly to be expected "that the process of compressing peat should "be profitably conducted; the expense of "suitable machinery, and the cost of labour "required for the operation, are necessarily "very considerable. In some countries, how-"ever, which do not, like Great Britain, possess "valuable and extensive coal-fields, compressed "peat may be employed with advantage, es-"pecially as a fuel for raising steam."

It has been employed for some years in the locomotive engines in Bavaria; but before this application was brought to a successful issue, many difficulties had to be surmounted. At Rosenheim, in South Bavaria, peat, after having been freed from roots, &c., is passed through rollers, dried and heated to about 100 C., and being thus obtained in a pulverulent state, is introduced into the pressing machines, and manufactured into bricks, weighing eight to ten ounces each. By this process it is rendered five times more dense; but it is not advisable to apply very great pressure, as the cost would be so much increased thereby, as to render the manufacture unprofitable. A cubic foot of the compressed peat weighs from about sixty-five to seventy-five pounds.

The most distinguishing character of peat as a fuel is its want of density, and too ready inflammability; hence it affords no means of concentrating the heat, which is dispersed with the flame, and in great part wasted in the chimney. Its available calorific power cannot be estimated at more than one-half that of coal; hence the attention that has been long directed to the possibility of obtaining charcoal or peat coke from it by partial combustion, or destructive distillation. Peat charcoal has been manufactured for many years; in our own country a patent for its use in the manufacture of iron was taken out in 1727. The great drawback to its being employed as fuel is its extreme friability, which renders it liable to be crushed when pressed upon by the weight of the materials in the upper part of the furnace.

This objection may be met by using compressed peat as the material from which the charcoal is made, but then we are encountered by the increased expense attached to the compression, this has hitherto been so great as to prevent its profitable application. When peat is charred in kilns, and the charring is performed by the heat derived from the combustion of a portion of the peat itself, it is most desirable to proceed on the plan adopted in the coking ovens, and conduct the process from above downwards.

When peat is charred in heaps, in the same manner as wood, the charcoal produced is very light, and so extremely combustible that it is apt to take fire as it is withdrawn. The amount of charcoal obtained by these different methods varies from 25 to 30 per cent. of the dried turf. Some few years since, great efforts were made to establish manufactures of peat charcoal in close vessels, in order that the materials produced by the destructive distillation of the peat might be utilised, but the process is expensive, and the distilled liquors do not contain substances of sufficient value to render it remunerative.

Sir Robert Kane, director of the Museum of Irish Industry, made a report to Government on the subject.

The following table gives the nature and amount of the materials obtained by the process as performed by two experimenters :—

One ton of dried peat yields.	Professor Hodges.	Dr. Kane.
Sulphate of ammonia	22¾ lbs.	24 1/5 lbs.
Acetic acid	7¼ „	4½ „
Wood naptha............	83 oz.	50 oz.
Tar	99 lbs.	53 lbs.

As gold may be bought too dear, so may these or any other valuable articles be manufactured at too great a cost to be remunerative, and it appears that the expense subsequently incurred in the purification of the tarry and watery liquids which are obtained in the first instance by the destructive distillation of peat is so great, as to preclude the hope that the manufacture will ever become one of national importance.

ON THE USE OF MECHANICAL HYPOTHESES IN SCIENCE,

AND ESPECIALLY IN THE THEORY OF HEAT.[a]

By Prof. Wm. J. Macquorn Rankine, LL.D., F.R.S., E. and L.

The object of the present paper is to illustrate the use of mechanical hypotheses in physical science, by giving a short account of the results which have been derived from that hypothesis which ascribes the mechanical action of heat to the centrifugal force of certain supposed molecular motions.

That hypothesis, like the wave-theory of light, the hypothesis of atoms in chemistry, and all other physical hypotheses whatsoever, substitutes a supposed for a real phenomenon, viz., invisible motion for tangible heat, the object being to deduce the laws of the real phenomenon from those of the supposed one. If the supposed phenomenon were more complex, or less completely known in its laws, than the real one, the hypothesis would be an encumbrance, and worse than useless. But this is not the case with the hypothesis of molecular motions as applied to heat. The laws of motion are at once simpler and more thoroughly known than those of any other phenomenon; and as the hypothesis in question enables the known laws of the mechanical action of heat to be deduced from the laws of motion, it tends towards the simplification of science, just as the hypothesis of undulations does, by enabling all the phenomena of reflection, refraction, diffraction, interference, polarisation, and dispersion whether of light or of radiant heat, to be deduced from the same laws of motion.

A hypothesis is absolutely disproved by any facts that are inconsistent with it. For example: the corpuscular or projectile hypothesis regarding light is absolutely disproved by the fact of the less velocity of light in the more highly refracting media, which is contradictory of one of its necessary consequences. The hypothesis of the substantial existence of "caloric," or the "subtle 'uid" of heat, is absolutely disproved by the fact, blished by the experiments of Rumford, Davy, r, and Joule, of the production of an un- quantity of heat from a limited quantity r by means of friction; by that of the of the specific heat of air at all densities, established in 1853 by M. Regnault; and by that of the almost total disappearance of the cooling effect of the expansion of gases, when they expand without performing work, established about 1851-2 by Messrs. Joule and Thomson. On the other hand, no hypothesis is capable of absolute proof, by any amount of agreement between its results and those of observation: such agreement can give at best only a high degree of probability to the hypothesis.

In order to establish that degree of probability which warrants the reception of a hypothesis into science, it is not sufficient that there should be a mere loose and general agreement between its results and those of experiment,—any ingenious and imaginative person can frame such hypotheses by the dozen; the agreement should be mathematically exact, to that degree of precision which the uncertainty of experimental data renders possible, and should be tested in particular cases by numerical calculation. The highest degree of probability is attained when a hypothesis leads to the *prediction* of laws, phenomena, and numerical results, which are afterwards verified by experiment; as when the wave-theory of light led to the prediction of the true velocity of light in refracting media, of the circular polarisation of light by reflection, and of the previously unknown phenomena of conical and cylindrical refraction; and as when the hypothesis of atoms in chemistry led to the prediction of the exact proportions of the constituents of innumerable compounds.

It is unnecessary to enter into any lengthened explanation as to the hypothesis of the radiation of heat consisting in the transmission of a vibratory or oscillatory movement, for that hypothesis forms in fact one theory with the corresponding hypothesis regarding light, the principles of both being identical, and the facts to which they are applied analogous in every respect. The perfect accordance of the results of that hypothesis with the phenomena of radiant heat, and the fact of the production of heat by the friction of solids and fluids, naturally suggest the probability that some similar hypothesis may be found to agree with the phenomena of the mechanical action of heat. And, in the first place, it may be remarked, that the loose and general agreement with the observed laws of the phenomena, which has already been mentioned as not being of itself sufficient to warrant the reception of a hypothesis, is possessed by every supposition which ascribes heat to the minute motions of the particles of bodies, of what kind soever the motions may be supposed to be; for every kind of internal motion would make the particles tend to fly asunder and occupy more space, and hence expansion by heat, and the evaporation of solids and liquids, which is an extreme case of expansion; it would make them press outwards against the boundaries of any space in which they were confined, and hence the increase of elastic pressure by heat; it would be communicated from particle to particle, and hence the transmission of heat; it would tend to dislodge the particles from any regular arrangement, and hence the softening and melting of solids, and the occasional decomposition of chemical compounds by heat; it would be increased in rapidity by the expenditure of mechanical power in the body, whether through friction, percussion, compression, or the exertion of electric, or chemical, or other molecular forces amongst the particles, and hence the production of heat by these means: the heat produced would also bear a constant ratio to the mechanical power exerted, the molecular motion would be weakened by the enlargement of the space occupied by the particles, and by their removal to greater distances apart, against external pressure and neutral attraction and hence the disappearance of heat in expansion, evaporation, and chemical decomposition; and in this case the heat which would disappear would bear the same constant ratio to the work performed against the forces resisting the expansion.

As an example of a hypothesis presenting this general agreement with the phenomena, there may be cited that proposed by Mr. Herapath and Mr. Waterston, which may be called the "hypothesis of molecular collisions," and which supposes particles to fly about in all possible directions with velocities, the mean of whose squares is proportional to the quantity of heat in a given weight of the substance. It is defective, however, in the agreement of its numerical results with those of experiment, inasmuch as it gives a fixed value 5 : 3, or 1⅔—for the ratio of the specific heat of a gas under constant pressure to its specific heat at constant volume; whereas that ratio is certainly known to be 1·408 for those gases in which it is greatest, and much smaller in others. Other defects of the same kind were pointed out by Professor Clerk Maxwell, in a paper read to the British Association at Aberdeen in 1859.

The hypothesis to which I have to call your attention as presenting the requisite precision of agreement with the results of experiments, and as having also predicted some of those results, is that which may be called the "hypothesis of molecular vortices," or the "centrifugal theory of elasticity," in which the elastic pressure produced by heat is ascribed to the centrifugal force of invisibly small whirls or eddies amongst the particles of bodies, the energy, or living force, of such whirls being the *quantity* of heat. The first idea of a supposition somewhat resembling this appears to have been put forth by Sir Humphrey Davy; but, so far as I know, no reduction of it to a definite form, nor investigation of its consequences on strict mathematical and mechanical principles, was published before the appearance of a paper which was communicated by me to the Royal Society of Edinburgh, in December, 1849, and which was read in February, 1850, and printed in the 20th volume of the "Transactions" of that body. The nature of the hypothesis, as set forth in that paper, will be best explained by the following extracts from the printed abstracts of that paper :—

"The hypothesis of molecular vortices is defined to be that which assumes that each atom of matter consists of a nucleus or central point, enveloped by an elastic atmosphere, which is retained in its position by attractive forces, and that the elasticity due to heat arises from the centrifugal force of those atmospheres revolving or oscillating about their nuclei or central points. According to this hypothesis quantity of heat is the *vis viva* of the molecular revolutions or oscillations."

* * * * *

"The author introduces into the hypothesis of molecular vortices a supposition peculiar to his researches, for the purpose of connecting it with the undulatory hypothesis as to radiation. It is this: that the vibration which, according to the undulatory hypothesis, constitutes radiant light and heat, is a motion of the atomic nuclei or centres, and is propagated by means of their mutual attractions and repulsions. The absorption of light and of radiant heat, according to this supposition, is the transference of motion from the nuclei or centres to their atmospheres, and the emission of light and radiant heat, the transference of motion from the atmospheres to the nuclei or centres. The author enumerates several advantages which he conceives that this hypothesis possesses over the common supposition of a luminiferous ether pervading the spaces between ponderable particles."

In the paper just referred to the application of the hypothesis was confined to gases and vapours; but in a series of subsequent papers, read in 1851, it was extended to substances in all conditions.[*] Amongst the consequences deduced by the application of the known principles of mechanics were *the two laws of thermodynamics*, by which, as is now well established by experiment, the results of all mechanical actions of heat can be computed with a precision limited only by the precision of the data.

The "first law" is the fact established experimentally by Mayer and Joule, about 1842-3, "that a given quantity of heat requires for its production, and produces by its disappearance, mechani-

---

'he Philosophical Society at Glasgow.

[*] These papers were reprinted in the "Philosophical Magazine" for 1850 and 1851.

sal energy bearing a constant ratio to the quantity of heat."

This law forms, of course, an essential part of any theory which regards heat as a form of motion. The numerical relation between heat and mechanical energy could be determined by experiment alone. Mr. Joule's experiments, after eight years of perseverance, during which the precision of his methods of experimenting was continually increased, gave at last 772 foot-pounds of mechanical energy as the equivalent of a British unit of heat ("Philosophical Transactions," 1850); a result whose exactness has been confirmed by every subsequent experiment.

The "second law" of thermodynamics was arrived at independently, and published simultaneously by Professor Clausius, of Zurich, and myself. It was arrrived at by Professor Clausius through the application to the first law, as demonstrated by Mayer and Joule, of a peculiar process of reasoning analogous to that which Carnot, in 1824, had applied to the hypothesis of fluid caloric, in his "Réflexions sur la Puissance Motrice du Feu;" it was deduced, in my investigations, from the mechanical hypothesis already stated, by means of the general principles of dynamics. Its experimental demonstration was not effected until about 1852, through the labours of Mr. Joule and Professor William Thomson. There are various different forms of stating the second law. The following is, perhaps, the most easily intelligible:—"The mechanical equivalent of the quantity of heat which disappears during a given expansion, or appears during a given compression, of any substance at a given constant temperature, is the product of the following three factors:—The change of volume of the substance; the rate of variation of its elastic pressure with temperature when the volume is constant; the absolute temperature," measured from a point 493·2 deg. of Fahrenheit's scale below the melting point of ice.

Amongst the predictions made by the aid of those two laws were the following:—Up to 1850 the received value of the specific heat of air, under a constant pressure of one atmosphere, was ·2669; and, in accordance with the hypothesis of fluid caloric, it was generally believed that a diminution of pressure produced an increase of specific heat, and *vice versâ*.

In 1850 I ventured to predict that the true specific heat of air under constant pressure would be found to be 0·24, or thereabouts, and very nearly constant at all pressures. It was not until 1853 that M. Regnault's experiments appeared, proving the truth of both these assertions. It was by means of the second law of thermodynamics that tables of the densities of saturated steam at temperatures ranging from 32 deg. to 428 deg. were computed from the known values of the latent heat of evaporation in 1853 and 1854, five years before the experimental determination of those densities by Messrs. Fairbairn and Tate, and similar calculations were applied with equal success to some other vapours.

The preceding results are consequences of the two laws of thermodynamics, whether we regard those laws as demonstrated independantly by experiment, or as consequences of a mechanical hypothesis. But the following are consequences peculiar to the hypothesis of molecular vortices, and not, so far as I know, deducible from any other supposition which has yet been put forth, as to the constitution of matter.

According to that hypothesis the elastic pressure of a gas or vapour consists of the centrifugal force of its whirling particles, partially counteracted by their mutual attraction. The pressure due to centrifugal force is the product of the density, the absolute temperature, and a constant quantity depending on the nature of the substance; and such is the law of the pressure of *perfect gas*, or one in which the effect of molecular attraction in partially counteracting the centrifugal force is insensible; while the diminution of such pressure produced by molecular attraction, is expressed by a series of terms increasing more rapidly than the simple power of the density, and proportional to the powers of the *reciprocal of the absolute temperature*. This last force, which may be called the *cohesion of gases*, is what distinguishes an imperfect gas from a perfect gas: it is very considerable in saturated vapours; less though still appreciable in the denser gases, such as carbonic acid gas, and very small in air. The cohesion of carbonic acid gas was found to be represented by the *square of the density, divided by the absolute temperature*, and multiplied by a coefficient deduced from the experiments of M. Regnault on the rate of expansion of that gas. Experiments were afterwards made by Messrs. Joule and Thomson on the disappearance of heat in overcoming this cohesion; and the results closely agreed with those deduced from the above-mentioned expression.

The hypothesis of molecular vortices, when applied to the question of the relation between the pressure of saturated vapour and the boiling-point of its liquid, did not give a precise result, for want of experimental data, but shewed it to be probable, that an approximate formula for the logarithm of the pressure of any vapour would consist of a constant, diminished by a series of terms proportional to the powers of the reciprocal of the absolute temperature. This conclusion was found to be completely verified by the vapours of water, alcohol, ether, sulphuret of carbon, mercury, and other fluids (see "Edinburgh New Philosophical Journal," July, 1849, and the "Philosophical Magazine," for 1854.

I think I am justified in claiming for the hypothesis, as a means of advancing the theory of the mechanical action of heat, the merit of having fulfilled the proper purposes of a mechanical hypothesis in physical science, which are, to connect the laws of molecular phenomena, by analogy with the laws of motion, and to suggest principles, such as the second law of thermodynamics, and the laws of the elasticity of imperfect gases, whose conformity to fact may be afterwards tested by direct experiment; and I make that claim the more confidently that I conceive the hypothesis in question to be in a great measure the development, and the reduction to a precise form of ideas concerning the molecular condition which constitutes heat, that have been entertained from a remote period by the leading minds in physical science; and amongst others by Galileo, Bacon, Boyle, Newton, Montgolfier, Seguin, Rumford, Davy, Leslie, and Young. As an example of the views held at the present time respecting it by eminent men of science, I may refer to Dr. Lloyd's opening address as President of the British Association, at the Dublin meeting in 1857, page 59. I may also refer to the fact that Professor Clerk Maxwell is now publishing in the "Philosophical Magazine" a series of papers, in which he shows how the laws of electricity may be deduced from the hypothesis of molecular vortices.

I wish it, however, to be clearly understood, that although I attach great value and importance to sound mechanical hypothesis as means of advancing physical science, I firmly hold that they never can attain the certainty of observed facts, and, accordingly, I have laboured assiduously to shew that the two laws of thermodynamics are demonstrable as facts, independently of any hypothesis; and in treating of the practical application of those laws I have avoided all reference to hypothesis whatsoever.

APPLICATION OF VAPOUR-GAS.

It has already been made known that M. de Beauregard has succeeded in making in as great abundance as can be necessary, de-saturated vapour at 250 or 300 degrees, by the perfectly regular and successive projection of a given quantity of water on the interior of a generator plunging by its base into a bath of tin; but the valuable applications of this power by that able engineer are novelties. For this vapour the Abbé Moigne's term "vapour-gas" is a happy expression, for it does not contain a single particle of liquid water, but acts absolutely like a gas, dilating regularly as every constant fraction of its volume is heated, while it can attain the highest fixed temperatures with or without pressure. At 1,000° it is almost a flame, and reddens the brass tubes through which it passes; moreover, it can be made to circulate like a current of fire, producing calorific effects the most varied and intense. In proportion as the temperature augments above a certain range, the affinity between the two gases which constitute the de-saturated vapour becomes less and less, until the molecules of oxygen and hydrogen, of which it is composed, do not interpenetrate any longer, but are, as it were, placed side by side, ready to separate and to secede the one from the other to any surrounding molecules possessing a greater or preponderating affinity. In this state the spheroidal vapour is become capable of a new class of effects, especially as an incomparable agent in efficient combustion. for it furnishes at once hydrogen which burns, and oxygen which supports the burning; whilst as a chemical agent, it has equally an illimitable power by the energetic reductive properties of its hydrogen and the still more active oxidizing properties of its oxygen. Experiments have already been made with success in steamboats. Temperatures up to 1,000 degrees can be attained without any trouble, regulated at will, or rendered fixed and immutable by a pyrometer of very simple construction. As a means of blast, its power is tremendous. Coming by a tube of very small section into the heart of a furnace charged with wood, coal, or coke, at 1,000 degrees of temperature, it fires the combustible, and at the same time decomposing by contact with the flame or the incandescent material, its oxygen unites with the carbon to make it burn better, while its hydrogen, thus becoming free, burns in its turn, and the furnace becomes the seat of a combustion intense beyond all conception. A small experimental furnace, about a metre in height, and 20 centimetres internal diameter, nearly filled with charcoal, had the vapour-gas introduced by a tube of less than a millemetre in diameter. The charcoal inflamed, the decomposition commenced, and a mass of flame 30 centimetres across, and more than a metre in height, was thrown out. When Scotch boghead coal was substituted, a flame of the like width, but several metres in height, rose to the roof of the laboratory. At present blast-furnaces are maintained by means of ventilators worked by powerful steam-engines, of which the boilers have an enormous volume, and are of truly colossal dimensions. Thus is ingendered, with great difficulty, a current of air, the pressure of which is about ten centimetres of mercury. The vapour-gas blast will hereafter displace these enormous machines; a generator of small size, and a super-heater still less, will suffice more effectually to inflame the sides of the blast-furnace, than any current of air so laboriously and so costly obtained. Applied to steam boilers, it improves enormously their conditions of heating. The great grates could be done away with, while the intensity of the combustion could be moderated at will; the fire at the same time being rendered completely smokeless, there would be no longer need for those enormous chimneys, which cost so much in the construction. Moreover, the furnace of the steam boiler may become an oven for the production of coke, perfectly de-sulphurized and fit for a thousand uses, thus reducing, in a very material proportion, the cost of the vapour employed as a motive power. Applied to locomotives, the ærhydric blast will revolutionize them completely. Generators of pure or bi-carbonated hydrogen, also, can thus be formed. Inclosing in a close chamber a mass of coke if pure hydrogen is to be obtained, or a mass of coal or boghead mineral if bi-carbonated is required, a jet of vapour-gas at 800° or 900° is admitted at the bottom, and with very small apparatus enormous quantities of gas are obtained,—a generator and tin-bath of six-horse power, furnishing an average of 250 cubic metres of gas per hour, and at an exceedingly low price. Applied to the distillation of schists for mineral oil, the reduction of metallic sulphurets, the baking of porcelain or glass, this means is at once the most effectual and the least costly, and it has been well said that M. de Beanregard "has conferred an inappreciable benefit on the industry of France and of the whole world."—*London Review.*

ON SOME RECENTLY-EXECUTED DEEP WELLS AND BORINGS.

By George R. Burnell, C.E., F.G.S., F.S.A.*

The term "artesian well" means, strictly speaking, only a well sunk to a considerable depth, through a dry and impermeable upper stratum, to a lower stratum charged with water, under such conditions of pressure as to cause the water to flow over the surface of the ground. The first wells of this description mentioned in modern works on hydraulics were executed in the province of the Artois, in France, where they were sunk in the chalk formation, and were supplied by the streams running between the fissures of that deposit, which were fed by the infiltration from the higher ground of the great north-eastern chalk plateau of France. It is said that some of these wells in the Artois have been used for nearly a thousand years without any perceptible diminution in their supply; but it must also be added, that the ancient Egyptians and the Chinese had, from the remotest antiquity, been acquainted with this method of obtaining water, and that the inhabitants of the plains of Lombardy have long used the waters rising from the deep-seated strata of the valley of the Po for the irrigation of their "marcite" or winter meadows.

It would be impossible to record all the important works undertaken of late years for obtaining water by means of artesian wells, but the circumstances connected with the history of those attempted at Calais, Kentish Town, and Harwich are so singular, that it behoves us to dwell upon them. At Calais the wall was sunk through the chalk, and the whole series of the subcretaceous strata, to a total depth of 1,047 feet from the surface, but no water was obtained from it, and the boring passed, at the depth above-named, into the transition rocks, in which it was carried for a further depth of 103 feet. At Kentish Town, the Hampstead Waterworks Company endeavoured to secure an artesian supply, in order to comply with the provisions of the Metropolis Waterworks Act of 1851. They had very wisely consulted Mr. Prestwich upon the geological questions involved in the preliminary inquiries, and they employed Messrs. Degoussé and Laurent, the best known and the most successful well-borers up to that period on the Continent. Geologists and practical men alike in this instance reasoned that, because the lower green sand outcropped around the edges of the chalk basin containing the London tertiaries in precisely the same manner that the lower green sand outcropped around the chalk basin containing the Paris tertiaries, therefore, there was every *à priori* reason to believe that the subcretaceous formations would continue under London, and furnish, as had been the case at Paris, the water for a well carried down to them. Acting upon this belief, the company commenced boring in the chalk at the bottom of a shaft previously sunk to the depth of 539 feet from the surface. The boring was commenced with a diameter of 12 inches, reduced to 10 inches in the intermediate part, and finishing with a diameter of 8 inches. The work began on the 10th of June, 1853, and was carried on with every appearance of success for a considerable time. The strata traversed were found to occur in their regular order, and of the anticipated thicknesses, until the boring had traversed the gault formation at the depth of 1,113 feet 6 inches from the surface; but when as Mr. Prestwich said, everybody believed that "a very few more turns of the augur would tap the water-bearing sands of the lower green sand formation," it was found that the borings passed at once into a series of beds consisting of alternate layers of red sandstones, red clays, conglomerates, red sands, and rounded pebbles, which geologists are now disposed to class amongst the new red sandstone series. It is very difficult to form any decided opinion as to the real nature of a deposit which has only been explored by the boring tool, especially when the diameter of the bore was only eight inches, as at Kentish Town, and I confess that for my own part, as I said before in this room, and shall have occasion again to repeat, I am disposed to regard the beds of red clays and sandstones rather as being members of the Wealden series than of the new red sandstone. But in either case it was evident that the water-bearing strata were interrupted under London, and that there was no probability of obtaining a supply of any description from them in that district. In fact, the Hampstead Waterworks Company, after the failure of this attempt, were compelled to sell their interests to the New River Company, and the well was stopped at the depth above quoted, added to the depth traversed in red sandstones and clays, or at a total depth from the surface of 1,302 feet.

About the same time that this unexpected result was obtained at Kentish Town, Mr. P. Bruff, C.E., was employed upon an attempt to obtain water for the town of Harwich, either by a deep well in the chalk, or by traversing, if necessary, the strata below the chalk. Several attempts appear to have been previously made at Harwich to obtain a supply from the chalk, but they had failed, in consequence of the infiltration of salt water into the wells sunk close to the sea-shore. Mr. Lankaster Webb, of Stowmarket, a town situated upon the high lands of the valley of the Gipping, the main affluent of the Orwell, had executed a well 895 feet deep, through the drift clays and gravels over the chalk, the cretaceous formations, and the upper green sands and gault. I do not know the level of the ground at Mr. Webb's factory, but as a rough guess I should say that it was about 240 feet above the high tide level at Harwich; and I am not, therefore, surprised that the persons connected with the well at the latter town should have expected that upon traversing the chalk they would meet with a supply of water under the true artesian conditions. It happened, however, that after the Harwich boring had passed through the drift, the tertiary strata, the chalk, the upper green sand, and the gault to the depth of 1,025½ feet from the surface, it passed, not into the lower green sand, but into a black slaty rock, which Mr. Prestwich pronounced to be a common grey slate of the palæozoic series, whose precise position in the series could, however, hardly be defined on account of the absence of fossils. Thus, at Calais, and I believe also at Ostend, the lower green sand is wanting, and is replaced by a member of the carboniferous series; at Kentish Town the lower green sand is absent, and it is replaced perhaps by the new red sandstone beds, whilst at Harwich the lower green sand is replaced by the very earliest clay slate rocks.

Now there may be drawn, from these unexpected results of the deep borings in the tertiaries of what may be specially named the London basin, some valuable scientific and practical conclusions. These may be briefly stated as follows:—1st. That at present geology is only so far advanced as to enable us to state, with tolerable certainty, what we shall *not* find under the surface, but by no means to justify any positive assertion as to what we *shall* find; thus knowing that the London clay is on the surface, we may be certain that the crag will not be found beneath it, but it by no means follows that necessarily the chalk, the lower green sands, the oolites, or the usually subordinate strata should be there. 2nd. That the first attempt to sink an artesian well through a previously untried stratum is at all times a hazardous experiment, and that it is, therefore, one which should never be tried by those who only work with the money raised by forced taxation. It was upon the latter ground that Mr. Ranger very properly recommended the town of Southampton to stop the philosophical experiment upon which they had already incurred so large an outlay; and it is certainly wiser to leave the solution of these problems to municipalities possessed of private resources, or to private enterprise, than to expend upon them the money wrung from the ratepayers. 3rd. And possibly this may be the most important conclusion of all—it would appear to be proved by the occurrence of the earlier strata in the geological series at Calais, Kentish Town, Harwich, and, if I be not mistaken, at Ostend also, that Mr. Godwin Austin's theory of an upheaval of the carboniferous series existing between its extremity on the French coast, and its reappearance in the Bristol and the South Wales coal field is correct. A full discussion of this important inquiry would be misplaced in this paper, but I cannot refrain from repeating what I myself have said before, viz., that from all which is at present known, it would be more rational to seek for coal under London than for soft water. At the same I would carefully guard myself against any appearance of encouraging an attempt of the former description, unless it were distinctly undertaken as a speculation, with great, nay, almost infallible, chances of loss.

The next important artesian borings executed of late years in chronological order were those undertaken under the superintendence of the French military authorities in the Desert of Sahara, avowedly for the purpose of forming stations for the caravans trading between Algeria and Central Africa. They were executed by means of tools made by Messrs. Degoussé and Laurent, who seem also to have occasionally acted as consulting engineers, but the works were actually performed by the soldiers, or the labourers employed by the "Corps du Génie Militaire." It appears that up to the month of June, 1860, no less than 50 of these wells had been sunk in the desert, and that they pour upon its thirsty surface no less than 7,920,000 gallons of water per day. Similar works were, according to Aimé Bey, executed in the deserts of ancient Egypt, as was before alluded to, and there are good reasons for believing that the system of artesian borings might advantageously be applied in the deserts of north western India and of Australia.

I now pass to the description of the great work lately completed at Passy, as being the one which has attracted the most universal attention. When the great works of the Bois de Boulogne were commenced, it was soon discovered that the pumps of Chaillot would not be able to furnish the quantity of water required for the lakes and waterfalls of the new park, and the Municipal Council of Paris, encouraged no doubt by the commercial results of the previous operation at Grenelle (which had eventually cost the sum of £14,000, and had repaid its cost several times over), resolved to execute a second boring to the lower green sand, in order to secure an independent supply. It was originally proposed to execute this well of the same dimensions as that at Grenelle, that is to say, to finish with an eight-inch bore; but before it was commenced, M Kind, a German engineer (who had already carried out some very important works upon a system, and by the aid of tools patented by himself), offered to contract for the new well to finish with a bore of 2 feet in diameter, and to deliver the water at 92 feet above the level of the ground, at the rate of nearly three million gallons per day. He undertook to complete the work for the sum of £14,000 within the space of two years. After some opposition, based principally on the doubts expressed by engineers, who had been consulted on the subject, with respect to the increased delivery over that of the well of Grenelle, this offer of M. Kind's was accepted, and on the 23rd of December, 1854, the vote of the Municipal Council in favour of the contract with him was passed. The work was commenced shortly afterwards, and by the 31st of May, 1857, the boring had already reached the depth of 1,732 eet from the surface, when suddenly the upper portion of the tube lining collapsed, at a distance of about 100 feet from the surface, and choked up the bore-hole. This accident delayed the completion of the work for three years, and led to the rescinding of the contract with M. Kind; but the engineers of the city of Paris were so satisfied with his zeal and ability, that they confided to him the conduct of the remaining works. A new well was sunk to a depth of 175 feet 4 inches, and the boring was then cleaned out and resumed. Much trouble was encountered in traversing the strata below the distance of 1,732 feet above quoted, and at length, at the distance of about 1,894 feet from the surface, the first water bearing stratum was met with, but the water, after several oscillations, did not rise to the level of the ground. The boring was continued below this level, until, on the 24th September, 1861, at midday, at the depth of 1,923 feet 8 inches, the true artesian spring was tapped. When this spring rose to the surface, it discharged at the rate of 5,582,000 gallons per day. The yield has since then oscillated, but so long as the column had not been raised above the level of the ground, the total quantity does not seem to have fallen short of 4,465,600 gallons. The well of Grenelle, which by the way had been falling off in its yield for some time before the completion of the Passy boring, no doubt on account of some obstruction in its ascensional tube, but which for several days before the 24th September discharged regularly 200,000 gallons per day,) fell, in about 30 hours after the Passy spring had been tapped, to a yield of about 173,000, at which rate it remained stationary, until the tube of the Passy boring was raised so as to allow the water to stand at the same height in the two wells, when the original rate of delivery of the Grenelle well was resumed, but the rate of delivery of the Passy well fell to two millions gallons per day. It is intended eventually to cause the column of water of Passy to rise to a height of 1,977 feet above the bottom of the boring, or about 54 feet above the surface of the ground The horizontal distance of the Passy well from the one at Grenelle is about 3,830 yards; and it will be observed from the section on the wall, that the water-bearing stratum is nearly 100 feet nearer the mean level of the sea at Grenelle than it is at Passy, whilst the surface of the ground is about 35 feet higher at the latter locality than it is at the former one.

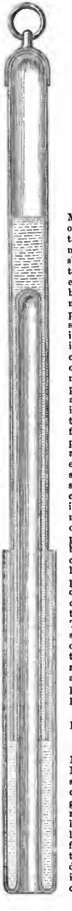
---

* Read before the Society of Arts, January 28, 1862, John Hawkshaw, Esq., in the chair.

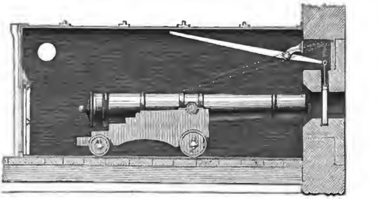
Unquestionably the effect produced upon the respective sources of supply, by the alteration in the heights of the columns of water, proves that the wells of Passy and of Grenelle are fed from the same stratum; and there can be no reason, therefore, to suppose that, when the Passy spring shall have cleared its water passages there should be any difference in the qualities of the waters at the two places. Mr. Peligot has carefully analysed the Grenelle waters, and he found that they contained 0·000142 of saline matters, composed principally of the carbonates of lime, potash, and magnesia, associated with a compound of sulphur, and of soda of variable proportions and conditions, and with the carbonate of the protoxide of iron and silica. The salts of the sulphate of lime, or of the more permanently insoluble description are absent, and it would appear that the gases diffused through the water are of considerable volume, the carbonic acid gas being one of the most so. There is a sensible evolution of sulphuretted hydrogen from both the wells of Passy and of Grenelle, and it is worthy of remark that the same gas is given off from the water in Mr. Gatehouse's well at Chichester, though in the latter instance the smell is sufficiently strong to render the water positively repulsive. At the present day the water at Passy is still foul, on account of the matters it brings up in suspension; but, as in the case of the Grenelle well, this inconvenience will no doubt soon disappear. The temperature at which it reaches the surface is identical in the two wells, and is about 82° Fahrenheit.

(To be concluded in our next.)

HOWSON'S
PATENT
BAROMETER.



PAGE'S METHOD OF WORKING SHIPS' GUNS.



HOWSON'S PATENT BAROMETER.

Mr. R. Howson, of Middlesbro'-on-Tees, Engineer, has just obtained a patent for "Improvements in Barometers," which consists in employing a tube similar to the common straight barometer, except that in place of the entire bore of the tube being filled with mercury or other fluid, the central part of it is occupied by a light stalk or closed tube, as illustrated in the subjoined engraving, leaving only a comparatively small concentric space for the mercury or other fluid; and instead of making the cistern for the surplus mercury or other fluid fixed as in the ordinary barometer, it is attached to the stalk or closed tube, so that the stalk, cistern, and fluid are held in suspension by the pressure of the atmosphere, and rendered free to rise or fall by every increase or decrease of pressure. By this barometer the pressure of the atmosphere can be ascertained either by the difference in the level between the top of the mercury in the cistern and the top of the column in the tube, by the position of the stalk and cistern, by the position of the top of the column of mercury in the tube, or, lastly, by means of a dial and pointer, the motion of which is derived from the motion of the cistern and stalk through the intervention of suitable mechanism. The vertical movement of the stalk and cistern, and the top of the column of mercury in the tube, can be made of any required range of scale corresponding to any given increase or decrease of pressure, by adjusting the relative proportions of the barometer.

PAGE'S METHOD OF WORKING SHIPS' GUNS BELOW THE WATER LINE.

Mr. Thomas Page, C. E., of Middle Scotland Yard, Westminster, proposes in vessels of war or other floating batteries to place a gun or guns each in a chamber, as represented by the above engraving, disposed below the water level, and into this chamber air is forced at a pressure greater than that due to the pressure of the depth of water at which the gun is placed. Each gun chamber is connected with a reservoir, in which a plentiful supply of condensed air is maintained. The gun being loaded, placed, and trained in position by suitable apparatus, a port is opened in the ship's side below the water level, and the gun is fired through such port, which is again immediately closed. The pressure of air in the chamber causes a rush of air outwards, and prevents the ingress of water to any extent while firing. Mr. Page proposes to bring the guns into sufficient proximity to an enemy's ship and fire it below the water level; the projectile will therefore pass through the water, strike, and enter the enemy's ship below the water line and so contribute to its destruction. Guns so situated may be worked by the men in the ordinary way, they being also in the gun pressure chamber.

Guns worked and discharged in compressed air chambers according to this invention would in most cases be fired point blank, and would not in any case require to be elevated, but in very close quarters with an enemy might be depressed with advantage. In practice, however, the gun might always be maintained at a uniform level, and in which case the port or hole in the ship's side may be made of a size to correspond somewhat in diameter to the muzzle of the gun. The gun having been loaded and brought into position, the supply of compressed air is admitted to the gun chamber. The port is opened and the gun discharged, watching the motion of the ship, and taking care that the gun is in a horizontal position at the time of the discharge, or it may have a slight depression from such motion if desired at such time.

GERMAN YEAST AND BREAD MAKING.

Nearly twelve months ago, I had the honour to read a paper before this Society, "On bread-making, with a special reference to German yeast." The general tenor of these remarks, particularly regarding the latter part of my subject, was of such a character as might have led not unreasonably to the expectation that, ere this time, plentiful supplies of the article then under consideration, would have been prepared in this city, and sold for the general purposes of trade. I have therefore thought it might not be without interest were I to lay before you, in the form of a supplementary paper, more information regarding the preparation of German yeast; and at the same time give to the Society such particulars as will satisfy those present that the non-production of solid yeast in this country, does not arise from any want of success in my process or manipulation, but is really dependent on other causes, entirely apart from this, and which have still to be met, and, if possible, overcome. Should the following remarks be considered uninteresting to any now hearing me, they will have this recommendation, that they may be depended upon as the results of actual experience and practical observation.

I may here premise, that the value and estima-

---

[*] Read before the Royal Scottish Society of Arts, by John Mackay, Pharmaceutical chemist, Edinburgh.

Digitized by Google

tion of German yeast have in no way diminished during the bygone year. Average importations from Holland and Germany, have continued steadily to arrive; while into the port of London alone, the printed weekly returns show the receipt of several hundred baskets from Rotterdam. The large and continued demand, as well as the general use of this article, are still closely confined to England; but I have reasons for believing that bakers, confectioners, and even private families, in many districts throughout Scotland where it has been hitherto unknown, will yet avail themselves of this excellent ferment, and whenever the manufacture has been fairly established, become regular and steady consumers. It may be here mentioned, that not only is this substance used regularly in Her Majesty's household, but so fond has the Queen become of bread baked with German yeast, that during her stay at Balmoral, there were supplies sent regularly twice a-week for the purpose of making bread and rolls for the royal table; while, to put the matter beyond all doubt, the following is a verbatim copy of a testimonial which was obtained some years ago from Windsor Castle, regarding the use of this foreign material. It bears date June, 1853, and is as follows:—"We, bakers in Her Majesty's household, certify, that the dried German yeast is not only at present, but has been for more than twelve years, in constant use in Her Majesty's household, in fancy bread, rolls, buns, and all sorts of cakes, for Her Majesty's own table; and, further, do assert that there is nothing to equal the article for any of the aforesaid purposes.

(Signed) "J. Hermann and N. C. Schafer."

With these few preliminary observations, I will now refer especially to the manufacture of this substance, which has for so long been a favourite on the other side of the Tweed.

Pursuing the investigations with which I had been previously engaged, I came to the conclusion that German yeast, as imported, was the yeast plant in a state of combination with some portions of the farina of the different grains with which it had been incorporated during the fermentation of the wort or infused seeds. This being my conviction, the peculiarities to be discovered and considered were,—

1. The true source from whence to obtain the rough material.
2. The time or state when such material could be made most effectively available.
3. The most perfect mode of manufacture, so that its original virtues might be retained unimpaired; and,
4. The best way of preserving and keeping this article fresh and in good condition.

I propose very shortly to consider these different points separately, and in the order just noticed. The first will be quickly settled. Some years ago, as I have already stated in my former paper, I tried to manufacture German yeast from brewer's barm, but was quite unsuccessful for reasons already given. I next had recourse to the liquid ferment then, and still supplied by barm companies to bakers for baking bread; but with this I also failed, in consequence of the absence of both quantity and quality. There was little solid matter in a gallon, and that little was decidedly deficient in life and power. Experiments were then commenced on distiller's yeast, and I found this was really the true source from which supplies were to be obtained, if the article was to be prepared in this country. The distiller's yeast is undoubtedly, up to the present time, so far as I know, the only source from whence we can draw material for the purpose of making a solid yeast, in every respect equal to the German yeast, so extensively sent over to England by our foreign neighbours.

The second, and certainly the most important point connected with this manufacture, and one which I think has been completely overlooked in any previous research, is the ascertainment of the precise and proper time for the removal of the crude yeast, from the surface of the vats. In my previous communication, I have already stated that the diastase of the malt effects, during its infusion with other grain, under certain conditions, the conversion of starch into sugar, in a manner similar to that in which this substance effects the same change during the germination of the seed in the ground, whereby the insoluble starch of the seed becomes the soluble saccharine matter, capable of affording nourishment and support to the young and tender plant. Now this transformation of starch into sugar in the distiller's hands is merely one step in the process; because he now induces fermentation by the addition of yeast, in order that the sugar in its turn may become broken up, and by a wonderful change of its elementary constituents, pass into alcohol and carbonic acid gas. This process commences of course almost immediately, when the proper arrangements have been made, and begins in a liquid containing, say, 44 lbs. of saccharine matter to every 36 gallons of wort. The disappearance of sugar and the substitution of spirit is called *attenuation*; and when healthy and perfect, this process goes on until there is no more sugar, and the liquid is then ready for the still. The yeast, having nothing more to do, falls to the bottom of the vat, *and becomes useless*. This I put thoroughly to the test, but found the albuminous mass difficult to work, and so inert as a ferment, that nothing could be made of it for baking purposes. It would, therefore, be naturally concluded, that when attenuation had been about half completed, and when the action was going briskly on, that this would be the proper time to skim the yeast. Such, however, is not the fact, because at this stage, solid yeast, though carefully prepared, was found to be useless in the hands of the baker; and not to dwell long on this point, I may at once say, that, as a rule, the strongest and most effective yeast is to be got when the saccharometer shows that nearly all the sugar has been decomposed; or in other words, we have the paradox of the yeast plant, when just about to finish its labours, and fall as a useless substance, proving itself at that particular time, better and stronger for the purpose of being manufactured into solid yeast than at any other. This statement is most important, because I am satisfied, if unattended to, no process which can be followed will ever prove satisfactory in its results.

We now come to the consideration of the third point:—

Supposing we are fairly started on a sound basis, by having skimmed or drawn off our raw material in a proper state, and at the precise time when it is in the best condition, it becomes necessary to take its specific gravity. This is also important, because it is amazing how yeast differs as to the solid matter it contains. Ranging from 12oz. to 2lb. I found to be the minimum and maximum weights of solid matter in each imperial gallon. The yeast must first, however, be carefully strained before being thus weighed, in order that husks, &c., may be got rid of, and then, having taken its specific gravity, it requires to be well and repeatedly washed in pure cold water until every impurity is removed. When all extraneous matter has thus been washed away, there will still be found adhering a certain quantity of acid, which can only be effectually removed by the addition of alkaline preparations. In connection with this part of the subject, I tried a great many experiments, and found more than one substance answer the purpose; but after repeated trials, I am disposed to give a preference to the pure crystalline sesqui-carbonate of ammonia. The proportions of this salt to be used must depend upon the amount of acidity present, as well as the quantity of solid material you have to operate upon; and which has been ascertained, as just recommended, by taking the specific gravity of the raw material after it has been got from the fermenting vat. Of course, the saturation and removal of acid can be known by the usual appliance of test papers, &c. The last water employed for washing away the acid from the yeast ought to be slightly sweetened with sugar. When this has been done, and most of the liquid poured off, what remains is to be thrown on a cloth filter, and allowed to remain there, until the soft pulpy mass is ready to be placed in an ordinary screw-press, surrounded with plenty of cloth; and when sufficiently pressed, may be removed, broken up, and packed into canvas bags ready for use. It may be proper to state here, that at times, when certain kinds of grain are employed in fermentation, a dark-coloured yeast is produced, which, being offensive to the eye, is at once rejected by the consumer. In the course of my investigations, I made several efforts to overcome this, and was to a certain extent perfectly successful. I found more than one harmless combination, from the use of which I was able to bleach or whiten the yeast thus discoloured—but with this drawback, that in every case the introduction of such substances lessened the fermentive power of the yeast; and this being of course an insuperable objection, I need not farther refer to the agents employed.

Having now got the German yeast prepared, allow me to refer to the fourth point, viz. the best mode of preserving it. And here there is not a little difficulty. Warm sultry weather, electricity in the atmosphere, damp, want of free access of air, rough usage, carelessness in packing, too much moisture in the yeast itself, keeping (however carefully) beyond a certain time—all or any of these will cause hasty and certain decomposition. I have thought and tried, and tried and thought again, of some means by which the liability of this substance to spoil might be overcome. I need not tire you by recounting successes and failures, but give you the result; viz., that while solid yeast may be hardened so that it will keep longer than the German preparation, yet in no case can this be done without detracting from its power as a fermenting agent; and these various experiments have led me to the conclusion, that the Germans have been prevented from using any such means, just in the same way that they have been foiled in drying and reducing their famous yeast to powder, so as to make it a more portable article, than it is ever likely to be. Many, I know, have surmised that the foreign yeast is regularly mixed with some farinaceous substance. My own impression is, that such is not the case, but that the yeast imported is simply the result of fermenting certain grain, the barm produced from this being collected and prepared in a similar manner, as has been already described. Like many other processes, great care and nicety are required in the manufacture, as it is something quite marvellous how a little neglect will destroy the whole vitality of this substance. Fresh healthy yeast, collected at the proper point of attenuation, and prepared according to the directions already given, packed and treated with ordinary care, and placed where air will circulate freely round it, will, I am satisfied, keep as long as the German, and prove equally powerful and useful for baking purposes. Place either German or Scotch made solid yeast in a cask or box, or otherwise exclude the air, and certain destruction awaits it; and hence the reason why no yeast ever arrives from Holland or Germany in any other than canvass bags placed in open hampers.

Having now glanced at the best manner of preparing solid or German yeast, it naturally follows that I should make some special allusion to the reasons why the manufacture of this article has not been already successfully established and carried out. Before doing this, I may be permitted to state, that, till October last, I was now and again engaged making this article, and sending out samples to those districts in England where I knew there was a steady demand for German yeast. Of many of these samples I received the best accounts; while several loaves of bread were baked here from each quantity of yeast I produced, and the bread so baked was a favourite with all who tasted it. Several noble and influential families in the country wrote more than once for small supplies, and one and all testified as to its goodness and usefulness in baking; as a consequence, I had applications from dealers in England, who would have contracted for several tons a week, had I been able to undertake their orders. But probably the most convincing proof of the fact that this substance could be prepared on the spot is to be found from the following circumstance. A German, who for fifteen years has supplied a certain district in England with Dutch yeast, entered into correspondence with me on the subject, and had several bags sent him from time to time, in order that he might distribute samples among his customers. At length I sent him the last sample bag I intended he should have, requesting his opinion of the merits of the same, and now give you an extract from his letter in reply, which is dated 12th September, 1860:

"The bag came duly to hand, and am glad to say it turned out all right. I was not able to give you a report respecting the strength yesterday, as I had to wait for the result after the baking process. I arranged, therefore, with a baker last night, to have it fairly tried against the Dutch barm, and was present till two o'clock this morning at the bake-house; to watch proceedings. Now the result is, that the Dutch sponge began somewhat earlier to rise than the sponge made with your lot; but after half an hour's working it kept pace together, and the two sponges were ready for the dough at almost the same time. In fact, we cannot find fault with the sample, and I trust you will soon be able to bring forward a competitive article. The bread I saw this morning was very good, and no difference could be observed when comparing the one with the other." Then follows an order for several baskets, and a proposal to contract for stated supplies. I might have added more evidence of a similar nature, but it would answer no purpose, because the above was perhaps the most severe test to which the Edinburgh preparation could be put, viz.: against that made at Rotterdam or Hamburg; inasmuch as, it was tried, watched, and compared, by one of the largest wholesale merchants, and a practical baker, to both of whom the peculiar merits of the preparation from abroad were intimately known. I presume, therefore, it needs not that I should make farther allusion, or adduce further proof as to the certainty, that a solid yeast, suitable in every respect for general use, can be made quite as well here as in Schiedam or elsewhere, but will now shortly refer to the reasons, why such a trade cannot at once be established.

The difficulties may be classed under two heads. *First*, Excise restrictions as to the distiller doing what he pleases with all the yeast he can skim or remove from his wash backs or fermenting vats. Last spring, a successful effort was made by application to the Board of Inland Revenue on this subject, and certain permission given to remove small quantities of yeast. To know the precise legal interpretation of this change, I addressed a note of inquiry to the Board, and received the following reply:—

"I beg to inform you that, by the Act 23 and 24 Vict., c. 114, 7, 4, distillers may remove yeast from a fermenting back to an extent not exceeding 2½ per cent. of the wash, and either sell, or add it to the wash in other backs. The Act came into force on 1st October, 1860."

Now, so far so good; but really, after all, the quantity permitted to be removed is not very great. Supposing that each gallon of yeast thus skimmed from the wash contained, on an average, 1½ lb. of solid matter, this would give only roughly about 4 lbs. weight from every 100 gallons, or 40 lbs. from every 1000 gallons of wash. But the distiller himself may require, and certainly can and will use, a certain portion of his own barm, for his own purposes, because, as is well known, there is much money spent in every distillery for the purchase of fresh yeast; and although it is also well known that a change of barm becomes a necessity for rapid and perfect fermentation, still a very considerable annual saving will be effected, by using, to a certain extent, the yeast thus so easily obtained within their own premises. It will therefore be seen at once that the Excise permission is quite circumscribed, and must be altered very considerably, if the preparation of solid yeast, in this country, for baking purposes, is ever to become a successful enterprise. In those places abroad from whence such large supplies are continuously sent into England, the excise rules and regulations are widely different. In the neighbourhood of Hamburgh, for instance, there are parties who infuse malt and grain for the sole purpose of producing yeast, while liberty is given to dispose of the wash remaining to the best advantage. I need scarcely remark that, were our Government to be seized with some such liberal fit, there would be, indeed, little fear of our competing successfully with the foreigner, and thus enabling us to keep in this country the very large sums of money, which, as yet, are every month sent out of Great Britain, in payment of this much prized substance.

The second reason is also an important one, and has only been practically brought to light during last summer. Unless certain descriptions of grain and malt are used, *there will be no yeast at all.* This is a most singular and striking fact in connection with the yeast question. The singularity becomes all the greater, when I explain that the chemical transformation from sugar to alcohol may go on under the fermentive process, while none of the yeast plant, alone, or in combination, will appear on the surface of the vats. The distiller, in this country, is often glad to use up any kind of seed containing starch, because he knows, in consequence of the power exercised by the malt, that substance will become sugar, and sugar again, in its turn, become spirit. This system is of course all the more readily followed when grain is either dear or scarce. Thus there is no certainty of the same description of grain being used in our distilliries for twelve consecutive months, which is just the reverse of what is practised on the Continent, where the only restriction is, that certain malted rye, of a particular kind, shall be used with healthy grain for the production of spirit; and hence the yeast produced partakes of the same characteristics, month after month, throughout the whole year. The fermentation is also carried on much slower, which in all probability will cause a larger proportion of yeast to be given out.

(*To be concluded in our next.*)

THE CAUSES OF THE HARTLEY CATASTROPHE.

At the coroner's inquest on the lives lost at Hartley, which commenced on Tuesday last, the following information was given:—

Mr. John Short, the engine-wright, gave the following dimensions of the engine and beam. The engine was of 300-horse power. The diameter of the cylinder was 86¼in., with a 10-ft. stroke inside, 9ft. 3in. outside, and seven strokes per minute. The beam was cast by Messrs. Losh, Wilson, and Bell, of the Walker Ironworks. Its weight was 42 tons. The weight which it had to lift, including the "spears" and the column of water, was 43 tons 18 cwt., and it was calculated to carry at least three times that weight, if not more. The length of the beam was 34ft. 6in., and the vertical section in the centre was 8ft. 2in. It was formed of two separate sides, joined together by bolts and studs. The diameter of the piston rod was 9½in., and its weight 4,816 lb. The weight of the piston was the same, and the weight of the cross-head, which was of malleable iron, and was fractured by the accident, 1,904lb. The cap of the cross-head, which was also fractured, was 3½ inches thick on the top side, and 3½ on the under side. The main dry spears or pumping rods were 14 inches square, and the bottom spears 10 inches square. They were of Memel pine. The pumps in the staple worked from the cylinder, and were not disturbed by the accident. The load of the engine was balanced by a counter beam and by a metal catch-pin. The bottom and middle pumps were 24 inches diameter in the barrel, and the staple pumps 20 inches. The steam was condensed on both sides of the cylinder. Mr. Short reiterated his opinion that the spears broke before the beam. The face of the fracture was quite bright, and there were no indications of a previous crack.

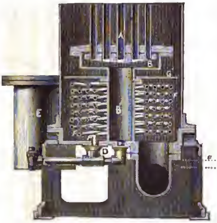
Mr. T. Hoskings, C.E., chief engineer to Messrs. Hawks, Crawshay, and Sons, was next called. He said that he had examined minutely the whole of the beam, and was of opinion that the metal was of very fair quality, and would be calculated to carry a weight considerably greater—at least four times as great—than that which it was carrying at the time of the accident. A sudden check, operating with other causes, would be very likely to cause it to break. He did not believe that the slipping down of the beam from the hydraulics when it was raised three inches out of the brasses would have fractured it, and certainly if there had been a crack then it would have gone on to complete fracture long before the accident, which he understood was several weeks after. The face of the fracture was quite bright, but if there had been a crack before it would have been rusted by the atmosphere. The sides of the beam were what were called opens and castings, which would not be so strong as box castings. The cavities in the beam revealed by the fracture had occurred from the contraction of the fluid metal during the process of cooling. Such cavities would always occur in cooling where there was a large section to cast, unless the metal abstracted by the contraction were supplied by a process of feeding. That might prevent such cavities occurring to a certain extent, but not altogether. The centre gudgeons or axles of the beam had been wedged and keyed into a hexagon hole in the beam. This must have required very great force—so much so that their heads showed strong marks of the "swages" used to drive them. The effect of this would be to throw an enormous strain on the cohesion of the metal surrounding the gudgeon-hole, and probably it would be one of the causes assisting to break the beam. In addition to that the angular shape of the gudgeon-hole was unfavourable to its strength; a circular hole would have been the best. Two of the angles of the gudgeon hole, those at the top and bottom, coincided with the line of fracture. The modern practice in fitting these gudgeons on axles was to bore a circular hole in the beam, turn the gudgeon to fit, and then simply secure it by one key. That mode threw the least possible tension on the metal.

On being asked his opinion of the cause of the fracture, Mr. Hoskings said there must have been two or three causes in operation. In the first place, he thought the gudgeon had been unduly keyed—driven home with unnecessary force. There had also been a want of due distribution of metal; there was too much metal in the centre boss, and the vertically curved ribs along it, instead of adding to its strength, would impoverish the metal in the line of the fracture. If the gudgeon worked hot—which he had been told was the case—a slight expansion would thus be produced, and, with the tight keying, this would be another operating cause of the fracture, especially at the time when it took place, there being a severe frost. Mr. Hoskings did not think that the pumps had got wedged, but the bottom spear had given way, judging from the fracture he had seen, from the weight which was on it. The wood did not appear to be of the best quality. The engine would thus be relieved from the outside weight, and the beam would strike violently on the spring beam inside, producing a severe shock, which, taken in combination with the causes he had before referred to, sufficiently accounted for the accident. A very slight and comparatively inexpensive engineering arrangement would be quite enough to prevent beams from falling under similar circumstances. Either a strong scaffolding might be built underneath, or it might be secured by trusses and iron bridles; but, in one way or another, it would be the easiest thing in the world to secure a beam working in such a dangerous position so that it could not fall down the shaft, if it should unhappily break in a similar manner.

DE NORMANDY'S REFRIGERATING APPARATUS.

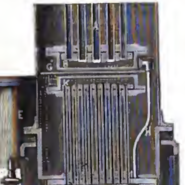
These improvements in refrigerating the fresh water produced by condensing steam, recently patented by Mr. A. De Normandy, of Clapham Park, Surrey, consists in arranging the apparatus in such a way that the condensing tubes, instead of occupying the whole length of the cylinder or vessel used for condensation (as in the apparatus known as Normandy's marine aerated fresh water apparatus), occupy only a certain portion of the upper part thereof, and the lower part is provided with a tube or tubes, or suitable refrigerating apparatus, so constructed and placed that the water condensed in the upper portion of the cylinder is refrigerated in the passing through the lower part of the condenser.

Fig. 1.



In Fig. 1, *A*, *A*, are condensing tubes fixed as usual in the condenser of the apparatus; *B*, inverted cap and central tube, into which the steam condensed in the tubes *A*, *A*, falls, and is led through a pipe into a T-piece *D*, where it mixes (if the apparatus be a double or multiple distillation one) with the water coming from the steam trap *E*, in communication with the evaporator of the Normandy's double distillation apparatus, which evaporator is not necessary to the understanding of the plan under consideration.

Fig. 2.



In Fig. 2, *A*, *A*, are condensing pipes, as before; *H* is the pipe leading the fresh water of the condensing tubes *A* from the cap *B* into a lower cap *I*, which receives the fresh water coming from the steam trap *E*, in communication with the evaporator; *J*, *J*, are pipes into which the fresh water, ascends from the lower cap *I* into the cap *K*, into which it is refrigerated by the condensing and refrigerating water, which fills the condenser, whence it issues through a pipe in a cooled state. This pipe may, if necessary, be cooled round and round the pipes *J*, so that the fresh water may thus be further refrigerated before its final exit.

DR. WHITE'S PLUMMETS AND GAUGES FOR LIQUIDS.

Fig. 1.

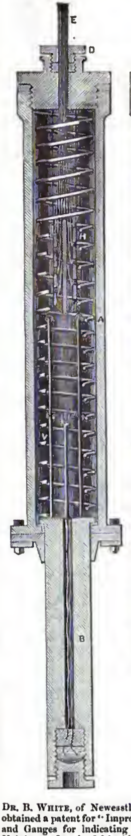
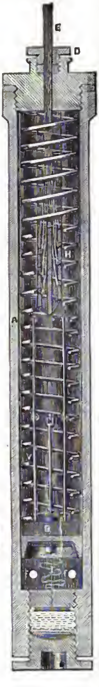


Fig. 2.



Dr. B. White, of Newcastle-upon-Tyne, has just obtained a patent for "Improvements in Plummets and Gauges for Indicating the Depth and the Height or Level of Liquids." This invention is more particularly intended to indicate on shipboard the height or depth of water that may have leaked into or otherwise entered the hold, but it is applicable to indicating the depth and the height or level of liquids generally.

According to one arrangement, the invention consists in the employment of a galvanic battery, a wire from one pole of which leads to a needle or series of needles or indicators, while a communication is established to complete the electric circuit by means of a float, or, in the case of salt water and other good conducting liquids, by the water itself rising and coming in contact with one or other of a set of metal plates placed one over another, and each having connected to it a separate wire leading to the indicating apparatus. The plates being at different levels, the indicating apparatus shows which plate is in communication, and consequently the height of the liquid.

According to another arrangement, an annular piston is employed working within a cylinder, and an internal tube containing the wires which lead to the metal plates, before mentioned. These plates are all connected with one pole of the battery, and a wire attached with a tongue to the piston, and which rises and falls therewith, is connected to the other pole. As the column of water presses on the piston (the pressure being proportionately counteracted by a spring or springs) it moves the tongue with the wire to one or other of the metal plates, and the needles or indicators show which plate is in communication, as in the former arrangement.

Fig. 1 and 2 are views of plummets, Fig. 1 having a solid ram or piston, and Fig. 2 a diaphragm piston.

A is a cylinder; *B*, a ram or piston; *D*, stuffing box, through which passes the wires from the insulated plates *H*, *H*; *I* is the coiled wire on the ram or piston to allow of motion; *J* is a cap or hollow containing mercury, two wires running from it to one pole, and two wires from the insulated plate to the other pole. A wire also runs from the tongues or wheels *V*, *V*.

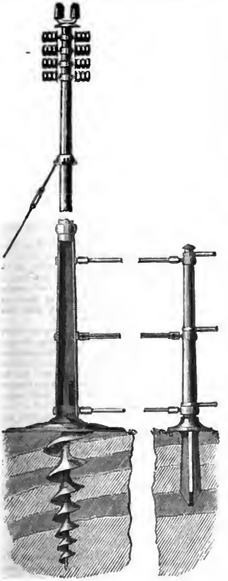
The operation is as follows:—There are wires extending from the plates *H*, *H*, passing through helices to a pole of a battery. When the plummet is sunk in the water the ram or piston operates against the helical spring and is pressed up, the cylinder as the plummet descends, carrying tongues or wheels which act upon the plates and corresponding needles. To the cup or hollow *J*, containing mercury, run two wires from one pole, and to an insulated plate near the cup run from the other pole two other wires. When circuit is established one rings a bell, the other deflects a needle. When the plummet reaches the botton it falls on one side, the mercury forms the circuit by flowing to the insulated plate, and indicates the same to wherever the wires may be conveyed. *F*, *F*, Fig. 2, are holes by which water is admitted to the cylinder below the plunger.

THE MOZARD MINER'S SAFETY LAMP.

At a recent meeting of the Society of Arts, Mr Le Neve Foster called attention to some specimens of a miner's safety lamp, exhibited by Messrs. John Abbott and Co., Gateshead.

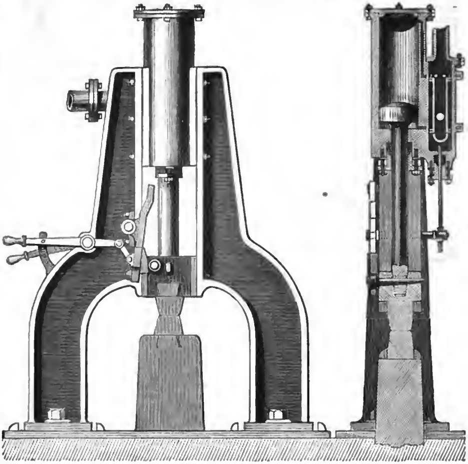
The body of this lamp is provided with a male screw, and the frame supporting the upper portion or top has a corresponding female screw. This frame has a cavity to receive a bolt, which is forced into it by a spring, and the top of the bolt having an inclined surface, it follows that when the lamp is lighted the top can be screwed on, but cannot return unless the bolt be lowered. The axis which carries the wheel for raising the wick has a projection which, upon the wick being lowered as far as possible, depresses the bolt; this lowering of the bolt, cannot, however, take place until the wick is drawn completely within the tube and extinguished. The lowering of the bolt whilst the wick is alight is effectually prevented by providing that the wheel for raising the wick cannot make more than seven-eighths of a revolution. This, if such a wheel be one inch in diameter, will allow two-and-a-half inches of wick to be burned before re-trimming the lamp, and is calculated to burn continuously for eighteen hours. The lamp has a solid iron chimney in the gauze top, so that it is impossible either to remove the top, or to draw the flame through the gauze. The glass is about three inches in diameter, and one-quarter of an inch thick, and the supports which carry the upper parts of the lamp would prevent the glass being broken, unless wilfully. The double plate above the gauze keeps the hand ring cool.

POTTS' METALLIC TELEGRAPH POSTS.



The above engraving shows an improvement in Telegraph posts, recently protected by Mr. F. Potts, of Lombard Street, Birmingham, the improvement consists in making or constructing them of sheet iron of a taper form, and of any desired shape in their transverse section, and using two or more segments or parts cut out of the proper taper form according to the size or proportion required at base and top. These segments or parts are shaped by pressure with the iron in a hot or cold state, as desired, or drawing them as far as practicable through a hole at a draw bench, and when shaped and put together they are secured by rings shrunk on hot or otherwise. The taper tubular part thus formed is united to a broad cast-iron or other formed base, with suitable means for securing it in the ground, as represented in the engraving. They may be galvanized or enamelled to protect the surface from oxidation; and in some cases the rings are formed with projections or flanges for the purpose of attaching tension rods, which may be secured to the base before described, or otherwise as desired, and to the projections or flanges of the rings, the said tension rods being tightened up by an intermediate coupling with a right and left handed screw; and for posts where great strength is required, the segments may be increased, each segment having a flange formed at its edge or meeting, pointing towards the centre, by which means great additional strength will be obtained. Posts thus constructed may be coated, finished as before described, and made short or long as required, and of any desired bulk, as, for instance, if used for supports for fencing, the rings may be formed at the ends of rails, so that by dropping on the rails, and striking them down in position, the parts or segments forming the posts will be held secure, and a continuous fence may be thus formed, such posts or standards being fitted with suitable means for resting on or fixing in the ground, having a convenient simple metallic or wooden boss to form a finish at the top end.

HOBSON'S IMPROVEMENTS IN STEAM HAMMERS.



HOBSON'S IMPROVEMENTS IN STEAM HAMMERS.

This Invention, just patented by Mr. W. Hobson, Engineer, of Ellesmere Road, Sheffield, contemplates the substitution of a simple self-acting motion and peculiar cylindrical valve for the complicated gearing generally in use. To the guide handle is attached a slotted or morticed tabbett, which moves upon an elbow tabbett connected with the rod which actuates the steam valve; the trip or hammer in moving strikes against the elbow tabbett, and therefore influences the sliding tabbett, rendering the combination self-acting. The valve is cylindrical, and acts vertically, it is formed with flanges, so as to admit of a concentric space for steam. When the valve is raised so that the top flange passes above the steam port or orifice in the top of the cylinder, this port becomes the inlet, and depresses the piston and hammer; the length of the valve is so regulated that the lower steam port in then below the lower flange and becomes an exhaust port, the steam passing off through the centre of the valve to the exhaust pipe at the top; when, on the contrary, the valve is depressed, the lower flange passes below the port in the bottom of the cylinder, which then becomes the inlet, the exhaust steam passing off by the top port to the outlet.

THE RESOURCES OF FRANCE.

The reports sent in by the heads of the various departments of France indicate the growth and prosperity of that country. The report on agriculture, commerce, and public works, states that not less than 12,762,972 hectolitres of wheat had been imported into France during the last six months of 1861, the result of so large a supply being a general decline of late in the price of bread-stuffs in France. The commercial treaty with England is described as having produced most satisfactory results, notwithstanding that the past year was not very favourable for industrial development, in consequence of the shock given to general business by the war in America. The new railway lines opened in 1861 extended to 655 kilometres (410 miles), and the length of those to be terminated in 1862 would be not less than 1,129 kilometres (705 miles). The whole length of railway lines now conceded in France is 18,236 kilometres, of which 10,096 kilometres are open to the public. The quantity of coal extracted in 1861 was 84,000,000 metrical quintals, worth 1f. 1c. per quintal, to 45,000,000 in 1851. The consumption of coal has increased in even a greater proportion, as from 74,000,000 quintals in 1851, it had risen to 140,000,000 in 1860, and would be most probably 150,000,000 in 1862.

The report of the marine is of considerable length, and will be interesting to our readers "The work of transformation of the naval m *tériel* continues to progress at the rate provided for by credits regularly allotted every year for the purpose, according to the plan adopted in 1857. As was made known last year, a greater number of our building slips up to the end of 1860 were unoccupied than had been the case for a long time past. The Government was awaiting the results of the trial of the first iron-cased frigate which was ever built, and the bold "initiative" of which belongs to France.

"After the success which has been obtained, to doubt was no longer permitted; the art of ship-building had made an immense stride; it was our duty, therefore, to resume the course of those labours which can alone keep up the naval power of the empire to the level it must preserve if we would not see it decline.

"We have done so without precipitation and without hesitation; the goal fixed beforehand in 1857, and which it was then proposed to attain in fourteen years, we are approaching with firm and steady strides, as befits a great country whose loyalty stands too high, and whose independence and might are too unquestionable, to permit of any indecorous hurry or slackness in the fulfilment of its most legitimate designs. At the present day the number of our men of war is 101, as appears from the following tabular statement:—

	New ships.	Old sailing ships transformed into auxiliary screws.	Totals.
Line-of-battle ships ...	12	23	35
Iron-plated frigates ...	2	—	2
Ordinary frigates	15	6	21
Corvettes	7	—	7
Avisos (*i.e.*, gunboats)	36	—	36
	72	29	101

Which would show for the year an increase of 13 new ships; but, on the other hand, 5 ships have been lost at sea, and 11 have been ordered to be broken up, as too old and unfit for service. Lastly, we have afloat and in course of completion 1 line-of-battle ship, 4 iron-cased frigates, 3 ordinary frigates, 6 gun-boats, and 2 floating batteries.

"The maritime inscription on the 1st of July has numbered 170,496 seamen—viz.:—

On board men of war	39,743
Shipped for long voyages on board merchantmen..............	31,047
Engaged in the coasting trade..............	33,150
Engaged in the coast fisheries	32,042
In private dockyards...........................	8,585
In their quarters..................................	25,929
	170,496

"The experiments for the improvements of naval artillery are being carefully carried on. Satisfactory results have been obtained, and we have reason to believe that in the construction of our *matériel* we shall have realized improvements at least equal to those of other nations.

"The supply of timber by means of contracts taken without any intermediate agents by the Administration of Woods and Forests is proceeding satisfactorily, as well as the supply of our harbours with French coal, which, henceforth secure, will be very soon further facilitated by the completion of the railways in Brittany, and enable us to dispense with foreign supplies

"The hydraulic works indispensable to meet the growing requirements of the fleet are being carried on with all the activity that the sums allowed for the purpose will admit. Six dry docks were completed in 1861 at Cherbourg, l'Orient, and Rochefort; others have been commenced at Brest and Toulon. The submarine foundation of Fort Chavagnac is progressing at the entrance of Cherbourg roadstead; the foundation of sea forts at Castignean, close to Toulon, is being laid; the quays of that harbour are now completed; the Vauban dock has been deepened; and a new one, that of Missiessy, has been commenced.

"Lastly, 135 electric signal ports, connecting every point of the seaboard of the empire with each other, will be at an early period provided with their apparatus, and will thus soon be able to render all those services which the defence of our coasts and humanity may require."

NON-ABSORBENT MATERIALS IN CONSTRUCTION.

MR. J. A. PICTON, in a communication on the above subject to the Builder, says:—

"I have perused with great interest the paper read by Mr. H. Roberts at the last meeting of the Institute of Architects, "On the Essentials of a Healthy Dwelling," and the discussion which followed. The efforts now put forth in the cause of sanitary reform cannot be too highly appreciated; but it is of the utmost importance that every step should be in the right direction, otherwise mischief may be the result, notwithstanding the best intentions.

"It seems to have been assumed in the discussion that walls to be dry and warm should be constructed of non-absorbent or non-porous material. Mr. Roberts, in his paper, and Mr. Chadwick, in his remarks, particularly insisted on this. The latter gentlemen observed that "he had repeatedly suggested the importance of using non-absorbent bricks in the construction of the dwellings of the poor; as every ounce of moisture got rid of contributed to make the dwelling more healthy." The object and purpose I cordially agree with, but my experience in the use of materials does not lead me to the same conclusion as to the means. On the contrary, I venture to assert that no material can be dry and warm that is not to a certain extent porous and absorbent. A building properly roofed in may be damp from two causes. The sub-soil may be humid and the walls porous and thin, in which case the moisture will rise from the floor and will penetrate the walls by capillary attraction; or the damp may arise from condensation of the moisture in the atmosphere on the inner face of the walls and floor. In the first case the remedy is simple and easy; by using a sound hard brick for the walls, and making them sufficiently thick, and for the floors, by laying underneath a non-absorbent material. The second cause of internal moisture is much more difficult to deal with, and will be found to exist just in proportion to the use of non-absorbennt materials in the walls. There is no building material, except glass and metal, so non-absorbent as slate; yet a house built with slate is known to be cold and damp. I resided in one in Wales for some time, and a more chill and comfortless habitation I never experienced. Again, wood we know is much more absorbent than either brick or stone; yet a wooden house is proverbially warm and comfortable. A wall of three-inch plank, well jointed, is more effectual in keeping in the warmth than a fourteen-inch brick wall. A little consideration will make this plain and intelligible. All substances conduct heat just in proportion to their density or specific gravity. The same principle will apply generally to their power of absorption inversely as the density. The effect, then, is this: a wall built with non-absorbent material rapidly rises and falls in its temperature. The air inside a house being usually warmer than that outside, has a greater capacity for moisture. As the wall conducts away the warmth, the temperature falls, and the super-abundant moisture condenses at the dew point on the face of the wall. Where the material is absorbent the conducting power is much slower; and, if any condensation takes place, it is to a great extent absorbed, to be again abstracted as the temperature of the apartment rises.

"I am not pleading for imperfect material; but I believe it to be impossible to make a nine-inch brick wall perfectly dry, whatever may be the quality of the bricks. If porous, the wall will be pervious to damp; and if non-absorbent, the moisture will be deposited on the inside on every sudden fall of temperature. A fourteen-inch wall of hard sound bricks, partially vitrified, will protect from damp both from without and within, under all ordinary circumstances. A case lately occurred in the course of my practice, which will illustrate the above remarks.

"A vault was constructed, in connection with a banking establishment, made of strong iron plates, rivetted together and surrounded by brickwork. This vault was accessible from the large room of the bank by a short flight of steps, the air during the day circulating freely from one to the other. Iron being a non-absorbent material, the vault might have been expected to be perfectly dry. On the contrary, it was found that papers deposited in it became saturated with moisture, whilst in the room above they were quite dry. The fact was, the warm air coming in contact with the iron walls, which rapidly conducted away the heat, was lowered in temperature, and discharged its humidity. The remedy applied was simply a small heating apparatus to keep up the warmth, which has completely answered its purpose.

"I cannot help thinking there must be some mistake in Mr. Chadwick's statement, that a wall constructed with hard-burnt bricks, 9 inches by 18 inches, could be built at a cost of two-thirds or three-fourths of that of an ordinary 9-inch wall. The cost of moulding bricks four times the ordinary size must be much greater, and the weight being so much heavier, the setting must cost more in proportion, whilst the mortar would be the same, or nearly so."

NOTES ON THE INTERNATIONAL EXHIBITION.

ONE conspicuous advantage arising from International Exhibitions may be now seen in Sheffield. We were told a short time since by competent authorities, that the manufactures of Sheffield would contrast unfavourably with those of several continental towns; not liking to be beaten, several of the masters and citizens of that town are putting forth their best energies. The Master Cutler writes to say, that if Sheffield is to be beaten, it will arise from the miserable small space allotted to their exhibitors. Whenever the day comes, we shall be disappointed if Sheffield is found behind any town of the Rhenish provinces.

It is proposed to establish an international supplementary Exhibition Company, for the purpose of affording room for productions which cannot be accommodated in the great Exhibition of 1862, and to furnish means for the sale of articles exhibited at either place. The building is to be completed for opening on the 15th of May. The charge for space will be 12s. per square foot for the floor, and 6s. for the walls, being less than one-half of the annual rental of the London bazaars, and the period will be from the 15th of May to the end of October. The design and supervision of the structure will be by Sir Joseph Paxton, and the trustees are Sir Robert Carden, Alderman Finnis, and Mr. William Jackson, M.P. The company, before taking any steps, ascertained that the project would not be objected to by the Royal Commissioners of the Great Exhibition.

The exhibition building, so far as its structural features are concerned, may be said to be now completed, and the commissioners will take possession of it on the day fixed by the contract—this day week, the 12th. The superintendents of the various classes will then occupy the offices appointed to them. The French commissioners will take possession of their portion of the building on the 13th, and they will be followed on the 15th by the Russian commissioners, and on that day the first consignment of Russian goods will be delivered in the building. The decorations have been placed in the hands of Mr. Crace, and the painting will be commenced immediately, and proceeded with as rapidly as possible. Of the effectiveness and suitability of the style of decoration we shall refrain from giving any opinion until so much of the nave has been completed as will enable us to judge of its merits. From the small portion which has been already painted we are disposed to form a favourable opinion of the design, and to believe that Mr

Crace has fully appreciated the difficulties which he will have to encounter in carrying out the decorations of the building. The domes are rapidly approaching completion; all the heavier and more important portions of iron-work have been raised and fixed, and in a few days a commencement will be made with the work of removing the enormous timber staging required for their construction.

In such an undertaking the correspondence must be various and voluminous. One writer asks, "Why don't you issue season tickets for less than three guineas? Because you are a set of asses and aristocrats, and make rules for yourselves, and those like you, who are either rich or unoccupied." Having answered the question in this complimentary manner, the writer of the elegant epistle concludes with the fiend-like wish, "May your Exhibition be burned down!" We refrain from giving the name of the writer, and are happy to find that, among all the thousands of letters which have been received by the commissioners (many of which are of by no means a complimentary character), there is not one besides this which has contained the slightest expression of ill-feeling towards the great national undertaking. In the midst of much disappointment and annoyance, there has been manifested throughout an earnest desire to make the Exhibition worthy of the country and of the age in which we live.

Messrs. Kelk and Co. have guaranteed to deliver the building to the commissioners on the 12th of this month. 4,500 men are working on the building daily. It has been decided to excavate three huge cellars for ale and beer, the cost of which will be £5,000. The road across Hyde Park will run from Victoria Gate, along the road by the side of the promenade and of the Serpentine. The following are the rules according to which the prizes will be awarded:—

"An international jury will be formed for each class and sub-class of the Exhibition, by whom the medals will be adjudged.

"Each foreign commission will be at liberty to nominate one member of the jury for each class and sub-class in which staple industries of their country and its dependencies are represented.

"The names of the foreign jurors must be sent to Her Majesty's Commissioners before the 28th of February, 1862.

"The British jurors will be chosen in the following manner:—Every exhibitor will name three persons to act on the jury for each class or sub-class in which he exhibits, and from the persons so named Her Majesty's Commissioners will select three members of the jury for each such class or sub-class.

"Her Majesty's Commissioners reserve to themselves the power of modifying these arrangements in any particular case where it may appear to them that the strict application of the principles of these decisions would be attended with injustice.

"The names of the jurors will be published in March, 1862.

"The juries will be required to submit their awards, with a brief statement of the grounds of each, to Her Majesty's Commissioners, before the last day of May, 1862.

"Should the reasons assigned for any award appear insufficient, or should no reason be given, Her Majesty's Commissioners reserve to themselves the right of confirming or rejecting it.

"The awards will be published in the Exhibition building, at a public ceremony, early in the month of June, 1862.

"They will immediately afterwards be conspicuously attached to the counters of the successful exhibitors, and the grounds of each award will be very briefly stated.

"If an exhibitor accepts the office of juror, no medal can be awarded in the class or sub-class to which he is appointed, either to himself individually or to the firm in which he may be a partner.

"The medals will be delivered to the exhibitors on the last day of the exhibition."

Dr. Letheby, the medical officer to the City Commission of Sewers, states in his quarterly report that no application has been made to him during the quarter for the analysis of food or drink, and he adds that "it is to be feared, from the experience of the last six months, that the Adulteration of Food Act will become a dead letter."

INSTITUTION OF MECHANICAL ENGINEERS.

THE fifteenth annual general meeting of the members of this Institution was held on Thursday, the 30th ult., in the Lecture Theatre of the Midland Institute, Birmingham; James Fenton, Esq., Vice-President, in the chair.

The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, the annual report of the Council was then read, which showed the very satisfactory progress of the Institution during the past year, and its prosperous condition, with a considerable increase in the number of members, referring also to the highly successful annual provincial meeting held in Sheffield last summer. The annual election of officers then took place, Sir William G. Armstrong being re-elected President of the Institution for the ensuing year; several new members were also elected.

A paper was then read, "ON A REGENERATIVE GAS FURNACE, AS APPLIED TO GLASS-HOUSES, PUDDLING, HEATING, &c.," by Mr. C. W. Siemens, of London. In this furnace, which is specially applicable where great heat is to be maintained and a pure clean flame is required, the fuel, which can be of very inferior quality, is first converted into a crude gas in a separate furnace or gas producer, and the heating power is greatly increased by the gas and air being both of them heated to nearly the temperature of the furnace itself, previous to entering and mixing in the furnace. This is accomplished by means of regenerators, by which the waste heat passing off from the furnace is intercepted on its way to the chimney, and transferred to the gas and air entering the furnace. Each regenerator is composed of a mass of open brickwork, exposing a large surface for the absorption of heat, through which the products of combustion are made to pass from the furnace, and are thus gradually deprived of nearly all their heat previous to escaping into the chimney. The end of the regenerator nearest the furnace becomes gradually heated to nearly the temperature of the furnace itself, while the other end next the chimney remains comparatively cool. The direction of the draught through the furnace is now reversed by means of dampers, which cause the air and gas entering the furnace to pass through the heated regenerator in the contrary direction, and direct the products of combustion through a second cold regenerator. The gas and air entering the hot regenerator encounter first the cooler portions of the brickwork, and acquire successive additions of heat in passing through the regenerator, until they issue into the heating chamber of the furnace at nearly its own temperature, filling it with a pure flame of equal intensity throughout the whole chamber. As the hot regenerator becomes gradually cooled by the abstraction of heat, the second cold regenerator becomes gradually heated at the same time by the products of combustion from the furnace, until the direction of the draught is again reversed by the dampers; and by thus alternating the currents of gas and air through the two regenerators, a very high degree of temperature is maintained constantly in the furnace. The gas used for heating in the furnace is supplied by a separate gas producer, in which a very thick layer of fuel is placed upon a sloping firegrate and ignited from the bottom, whereby the gaseous portion of the fuel is volatilised, and the combustible gases are increased in quantity by the decomposition of steam supplied gradually from a water trough at the bottom of the fire-grate. By this mode of employing the fuel in the form of gas and keeping the fireplace separate from the furnace itself, the most inferior descriptions of fuel can be employed for heating purposes, such as the refuse slack of collieries, and coke dust, without interfering with the purity of the flame in the heating furnace, since all solid fuel is kept at a distance. The gas, and the air required for burning it, are each heated in separate regenerators, being kept entirely distinct until they issue through adjoining openings into the heating chamber, when an intense and perfect combustion immediately takes place, the quantity of each being adjusted by separate dampers, so that the flame is regulated with great facility and maintained steadily at the exact heating power required, while smoke is altogether prevented; and by closing the dampers the flame is at once reduced to any extent desired.

These regenerative gas furnaces are at work successfully for glass making at Messrs. Chance's, Messrs. Lloyd's and Summerfields, and Messrs. Osler's glass works, near Birmingham, the one at Messrs. Lloyd's having been in constant work for nearly a year; and the furnaces are now being applied extensively for a variety of purposes, with highly satisfactory results in the heating effect obtained, and with an important economy of fuel. They are also in use for heating and welding wrought-iron tubes, and for other heating purposes in ironworks, and several are now in course of erection for puddling; in the latter case the saving of room by doing away with the fireplaces, chimney stacks, and stores of fuel required with ordinary puddling furnaces, is a point of considerable importance, enabling the furnaces to be arranged closer together, and nearer to the hammer. For steel melting, which requires the highest heat used in the arts, the regenerative furnaces are being applied extensively in Germany, where one of them has been in satisfactory operation for a considerable length of time, being worked with lignite, a fuel little superior to peat in heating power. In the South Staffordshire district, and other districts where good coal is scarce or expensive, but where an inferior fuel abounds, the economy of the regenerative gas furnace is the greatest, as it renders available for heating purposes the refuse slack and coal dust, at present of no commercial value, but which on being converted into gas, will acquire a heating value in the regenerating furnace equal to that of the same weight of the best coal as at present used in ordinary furnaces.

In the evening a number of the members dined together in celebration of the fifteenth anniversary of the Institution.

MEETINGS FOR THE WEEK.

MON.—*Royal Geographical Soc.*, I. "Dispatch from Sir Henry Barclay, Governor of Victoria, on the Expedition which succeeded in crossing the Australian Continent, from Melbourne to the Gulf of Carpentaria," communicated by His Grace the Duke of Newcastle. II. "Journals of the Expedition, with the Astronomical Observations of Mr. Wills." III. "Proceedings of the Exploring Party in North West Australia." IV. "Letter from Capt. Cadell on the country east and north of the Grey and Stanley Ranges," at 8.30 p.m.
London Inst., "On the Manners and Customs of the Japanese," by D. J. Macgowan, M.D., at 7. p.m.
Geological School, Jermyn St., "On Applied Mechanics," by Prof. Willis, at 12 a.m. "On Geology," by Prof. Ramsay, at 1 p.m.

TUES.—*Inst. Civil Engineers*, Continued Discussion upon Mr. Samuda's paper "On Iron-plated Ships," at 8 p.m.
Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., F.R.S., at 3 p.m.

WED.—*London Inst.*, "On Commercial Law," by G. W. Hastings, Esq., at 7 p.m.
Society of Arts, at 8 p.m.

THUR.—*Royal Soc.*, at 8.30 p.m.
Antiquaries, at 8.30 p.m.

FRI.—*Royal Inst.*, "On Mr. Graham's Researches on Dialysis," by Dr. W. Odling, at 9 p.m.
United Service Museum, "Iron and Steel as materials for War Purposes," by John Anderson, Esq., at 3 p.m.

SAT.—*Royal Inst.*, "On the English Language," by Rev A. J. D. D'Orsey, B.D., at 3 p.m.

The Council of State of the Canton of Geneva has granted a concession for the construction of Horse Railways in the Canton, to Mr. Charles Burn, C.E., the author of the Treatise "On the construction of Horse Railways for branch lines and for street traffic." A commencement is to be made by constructing a line from Geneva to the small town of Carouge, two miles distant. We understand that the works have already commenced, and that the first line will be opened for traffic on the 1st of May next. Mr. Burn will lay down his Patent Grooved Rail. The cars will be constructed on the American system, and are now being built at the Street Rail Car Works, at Birkenhead.

TO CORRESPONDENTS.

Received.—J. B., W. P. M., Capt. N., J. D., W. D. M. M., J. A. D., R. P. E., Capt. S. and S. P. P., W. P. M., C. B. K., J. McC., D. and L., J. P., Prof. S., Merestor, W. P., H. E. R., W. W., Millwright, W. C. B., Enquirer, J. R., W. R., S. T. W.

The Hartley Catastrophe.—The subscriptions announced in our last number have been transmitted to the Lord Mayor to be forwarded by him to the proper quarter.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

MR. SAMUDA ON IRON-PLATED SHIPS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I should be glad, with your permission, to consider some of the points involved in the statements which were made last week by Mr. Samuda, at Great George-street, in the matter of iron-plated ships, and of which you published a summary in your number of the 31st ultimo.

He complains that the construction of the Warrior is complicated and costly, and recommends that the framework of the hull of such ships should be built as in an ordinary first-class steamer of the same size.

One would have expected the charge against the Admiralty designers would have been, that while the extraordinary dimensions of the ship, and the great and unusual strain which would be brought upon the upper portions of the frame, called for a special mode of construction, the old modes had been adhered to with the usual tenacity.

The fact, however, was that the great increase of longitudinal strength afforded by the system employed by Mr. Scott Russell, in the Great Eastern, rendered it desirable to apply it as far as possible in the new design; the ordinary transverse framing being combined with it, for the purpose of obtaining proper support for the armour.

The economy of the mode adopted may, however, be best seen by comparing in several ships, the weight of material expended in the hull for each ton of builder's tonnage.

I shall be able to do this from some notes which I have preserved on the various designs which were prepared for the Admiralty by the most eminent English shipbuilders when the Warrior was designed.

The weight of material, exclusive of armour plates, for each ton of builder's tonnage stands as follows:—

	Tons.
Mr. Scott Russell	·48
Messrs. Westwood and Baillie......	·53
Mr. Mare..................................	·57
Mr. Laird..................................	·73
The Warrior	·77
Mr. Samuda	·83
Thames Shipbuilding Company ...	·86

From which it appears that in Mr. Samuda's opinion, there should have been in the Warrior an additional hundred-weight of material for each unit of tonnage.

But Mr. Samuda submits two designs of his own. The larger one he calls a 32-gun frigate. This we presume to be a mistake, as we are afterwards informed that she will be able to carry as heavy an armament as the Admiralty ships of 6,700 tons now building. These ships, as must be very well known to Mr. Samuda, are to carry fifty 100-pounder guns. He says they will cost £400,000, each, or £8,000 per gun. His will cost £340,000, which for 32 guns would be more than £10,000 per gun, and the argument of economy urged by him would be turned against him. I will therefore assume that his second statement is correct, and that the proposed ship is to carry 50 guns. His ship will thus cost £60,000 less than the Admiralty ship.

Observe, now, how this is effected. It is not by simplifying the construction, or by the adoption of a different mode of protection, but simply by making the ship narrower.

Ships are paid for at so much per ton. Tonnage increases as the square of the breadth. Let us, therefore, argues Mr. Samuda, retain the length of the Warrior, and cut down the breadth three feet. But Mr. Samuda has forgotten that although the tonnage increases as the square of the breadth, the stability of the ship increases as its *cube*.

Let us see, so far as we are able from the information afforded us, how the matter of stability stands; and we shall allow, for the sake of the argument, although it is not true, that Mr. Samuda's 5-inch plates, upon a skin one inch thick, will offer as much resistance to penetration by shot as the Admiralty 4½ inches of iron upon 18 inches of teak, and a half-inch skin.

If half the inch-skin is taken with the hull, we shall then have to consider as armour 5½ inches of iron. This will weigh 1,600 tons. Add to this Mr. Samuda's own weight of hull, viz., 4,600 tons. Then, allowing for smaller engines and lighter masts, the weights to go on board will be, say, 60 tons less than those which will go on board the Admiralty ships, or about 3,150 tons, including 254 tons for guns, 900 tons for engines, 938 tons of coals, and provisions and stores for 700 men. Adding these together, we get a total weight of 9,350 tons.

This is 700 tons heavier than the Warrior. How she is to be made, with less engine power, to go faster than the Warrior does not appear.

This additional weight can only be carried, in a ship three feet narrower than the Warrior, by increasing the draft of water and filling the section. The centre of buoyancy will by this means be lowered with regard to the water line about six inches. The height of the metacentre above this point will be reduced by narrowing the ship, from 13 ft. 6 in. to 11 ft. 1 in. The centre of gravity of the hull will be raised by the additional plating 9 in. The combination of these changes reduces the distance between the centre of gravity and the metacentre, which, together with the weight of the ship, is a measure of the stability, from 5 ft. 3 in. to 2 ft. I have no hesitation whatever in saying, that such a ship would never dare to hoist her canvas in a breeze of wind, and would be utterly useless as a ship of war.

Mr. Samuda does not furnish sufficient information with regard to his smaller design to enable me to prove, what I suspect to be the fact, that the dimensions proposed by him are too small to give him with the greatest imaginable fulness of form, the displacement he requires.

This much, however, is certain, that if the ports are as high out of the water as those of the Admiralty Coast Defence vessels, vis., 7 feet 6 inches, he will require 800 tons of his proposed plating.

If we were called upon to hazard a guess at the speed of such a vessel, let us see how we might go to work.

There is a vessel of war called the Imperieuse, whose mean draft of water is 21½ feet, and the dimensions of which are something like those proposed by Mr. Samuda. Her speed does not reach, when she is loaded, 10 knots. We must, however, so alter the form of this ship, as to enable her to carry some three or four hundred tons additional weight. This must of course be done by causing her to make a larger hole in the water. But to bring her to Mr. Samuda's dimensions, we must at the same time shorten her 12 feet, narrow her 18 inches, and reduce her draft of water 4½ feet.

Having, if possible, constructed the "tub," or washing tray, which will perform these conditions, reduce the power of the engine from 360 to 350 horses, and the diameter of the screw from 16 feet to 14 feet. What shall we we then say for the speed? Is there one of your readers who will endorse Mr. Samuda's statement, that after the metamorphosis, we should have a knot more speed?

Mr. Samuda concludes his paper by expressing the opinion, that in the construction of mail-clad vessels, the Admiralty had better abandon their present course of originating designs themselves, and "trust to the engineering skill of this country." That they should *avail* themselves of the skill of private shipbuilders and engineers, is, I think, their duty, and they appear to think so too; but that they should *trust* it, Mr. Samuda has failed to show.

I am, Sir, your obedient servant,

NATHANIEL BARNABY, Mem. Inst. N. A.

London, 4th Feb., 1862.

◆

PEAT FUEL.

SIR,—As you have commenced what is likely to be an admirable series of articles on "Fuel," perhaps you will allow me space for a few observations on peat.

In judging of the economic value of peat as a fuel, it must be remembered that three principal qualifications bear upon that value, and cause the relative effects of different samples to vary in a much greater ratio than is observable in the case of coal. These qualifications are, 1st, chemical constitution; 2nd, dryness, *i.e.*, freedom from water *mechanically* combined; 3rd, hardness or density. The first only of these qualifications practically effects the value of coal, which does not vary much in dryness or density. It is, therefore, obvious that much greater care is required in the selection of peat fuel than in that of coal. The "duty" of much of the German and some of the poorer Irish peats, containing, say, 10 per cent. ash and 0 per cent. water (a very usual condition), cannot be estimated of more than one-fifth that of good coal, and if, in addition to the above disqualifications of ash and water, the article be of a light and spongy texture, it is altogether unfit for most of the purposes to which coal is applied. On the other hand, good dark brown peat, completely free from mechanically combined water, containing only 2 to 3 per cent. of ash, and consolidated to a specific gravity of 1·3 is found to be actually equal in duty to many common qualities of English coal, and capable of performing at least two-thirds the work of the best steam coals, against which it has frequently been tested. Between these extremes there will be found every shade of difference in actual value, depending on the three qualifications already mentioned. Much attention has, however, been lately directed in Ireland to the preparation of peat fuel of superior quality, and as there is now for the first time a factory in practical operation in Ireland, producing a really valuable peat fuel, it is to be hoped that the manufacture will rapidly extend, and that peat will in future be used in a much better condition than heretofore. Dryness and density equal to that of coal being attained, it was theoretically to be expected that the above practical result would follow where the peat was, in the first place, of good natural quality, for in such peat the main constituents are, carbon 65, hydrogen 6, and in good coal the average of the same constituents may be taken as carbon 85, hydrogen 5. Peat generally contains 1 per cent. more hydrogen than coal, which is the same in effect as if it contained 4 per cent. more carbon than it actually does; theoretically, therefore, the relative effects of good peat and good coal should be as 69 to 85, and practically, when density and dryness have been attained in peat, the result bears out this theory, but deficiency in either qualification is altogether prejudicial to the duty of the fuel. Peat fuel brought to its most perfect state, can be used for all the purposes to which coal is applied, and possesses some minor advantages over coal, which, though they can never compensate entirely for its inferior "duty," will yet be found greatly to enhance its value. When quite dry peat is almost without smoke, and leaves very little soot; its ash fuses less than the ash of almost any coal, and it is free from all but the slightest trace of sulphur. As a house fuel it is certainly clearer than coal, and its embers remain lighted for many hours without the addition of fresh fuel, which, under many circumstances, is found to be a very useful property.

CARBON.

◆

FOWLER'S WINDLASS.

SIR,—In your magazine of yesterday you give an engraving and description of what is called Fowler's New Windlass. If you examine the patent list you will find that I took out a patent, April 22, 1856, for the identical machine, except the break wheels and shaft. I afterwards abandoned and have since found that it is constructed upon the worst of principles, that of the drums grinding themselves away round their own axis, besides the waste of power in grinding themselves round a thick axis, which it must be to stand the pull of a 8 or 10 horse-power engine. All there is belonging to Fowler is the break shaft. What good is there in that? Certainly not a transmission of power from drum to drum, for that is impossible; a dead weight can do all it does, but I have never yet learned that a machine in motion can effect what a dead weight can do without a consumption of power. I have practically tested the point, and proved that this taut rope keeping is wasteful of power, in some cases full 2 horse-power. Then this machine is not only wasteful of power but extravagant in wear and tear, by the break wearing itself out with the drums.

I am, Sir, your obedient servant,

WILLIAM SMITH.

Woolstone, Bletchley Station, Bucks, Feb. 1, 1862.

◆

CAST AND WROUGHT IRON GIRDERS.

SIR,—In looking through "The Engineer's, Architect's, and Contractor's Pocket-book" for the present year, published by Lockwood & Co., I find, at page 353, an extract from Fairbairn's treatise on cast and wrought iron, which reproduces the statement that a wrought iron beam of the same depth, bearing, and strength, as a cast iron one, would only weigh a little more than one one-third that of the cast iron beam. Mr. Fairbairn's formula $W = \frac{a\,d\,c}{l}$ is the same for both cast and wrought iron, by altering the constant C from 26 for cast iron to 75 for wrought iron, which does give the bottom flange of the cast iron beam about three times the area, and consequently about three times the weight, of the bottom flange of the wrought iron beam; but Mr. Fairbairn also teaches

Digitized by Google

that the top flange of a wrought iron beam should be twice the area, and consequently twice the weight, of its bottom flange; and that the top flange of a cast iron beam should be only one-sixth of the area, and consequently of the weight of its bottom flange. The top flange of the wrought iron beam would therefore be four times the area, and consequently four times the weight, of the top flange of the cast iron beam. If we call the bottom flange of the wrought iron beam 2, its top flange would be 4, which, together, would equal 6; while the bottom flange of the cast iron beam of equal strength would be 6, and its top flange 1, which together equal 7, instead of nearly 18, as should be the case did the wrought iron beam weigh only a little more than one-third that of the cast iron beam. A reference to this erroneous conclusion in Mr. Fairbairn's treatise appeared in your journal of October 13th, 1855. T. M.

◆

HEAT.

Sir,—Referring to the very instructing particulars respecting "heat," which has just appeared in your columns, permit me to remark, that, though when through a slow draft or otherwise, insufficient oxygen is supplied to fuel in combustion to produce carbonic acid, and consequently carbonic oxide is formed instead, with an important loss of heat, yet, with a judicious admission of atmospheric air to the flame after it has left the furnace (in any mode employed for using heat of 1,470° "brilliant red," or in a higher state, whether it be on the flue or oven principle), the combustible carbonic oxide will burn with a bluish flame evolving considerable heat. This oxide by perfect combustion is converted into carbonic acid, the same gas as would have been formed if sufficient oxygen had passed through the furnace. I have found in practice that several air holes opening into the flue, the size in the aggregate being one-thirtieth part of the sectional area of the flue at its most contracted part to be sufficient. The outer air is sucked into the flue by the draft therein, converting besides the set free carbon diffused through the heated gas, as smoke, into carbonic acid.

I am, yours truly,
George Walcott, C. E.
Feb. 4, 1862.

◆

THE HARTLEY CALAMITY.

Newcastle-upon-Tyne, Jan. 28, 1862.

Sir,—The "Hartley calamity," details of which have long ere this spread through the length and breadth of the land, leaving a sad memento of misery and pauperism as a legacy to that locality, might, in our opinion, have been avoided if the pumps had been made of bitumenized paper pipes (similar to those which have been lately so extensively supplied in this district for water and gas purposes), instead of iron. Our reasons for this suggestion are as follows:—

Had the pumps been of bitumenized paper, instead of iron, the "saw and axe" of the "deputy" found at the entrance of the yard seam would have been able to do some good execution, as he might have sawed a portion of the pump away, thereby causing a current of air to ascend to the surface, and keeping that part of the mine where the men took refuge free from that deadly carbonic acid gas, or choke damp. In addition to this, the parties in charge at the surface could have communicated with the miners by putting on the "crab-rope" (which has already done service in bringing the bodies of the men from the mine) to the spears or pump rods, and drawing them out, thereby making the pumps (which we are informed are twenty inches in diameter) available as a means of ventilation, and perhaps of rescue. A man might have been lowered down by the gin or crab-rope, who being prepared with a carpenter's brace and bit, and a small sweep-saw, could have cut a hole any size opposite to where the "jowling" was heard, and so have communicated with the unhappy sufferers; but the pumps now at Hartley being of 1½-inch cast iron, of course the process above spoken of could not have been applied, as there would not be space to work the tools generally used for boring iron, &c.

Trusting these suggestions may lead to future good, We are, sir, your obedient servants,

J. H. and J. H. Little, Engineers.

The Rev. Charles Kingsley says:—The main causes of decay in trees are, I think, after long experience:—1. The cutting or burying of the main roots by drainage, as stated by Mr. Hewitt Davis. 2. An undrained and sour subsoil, through which no roots will penetrate save those of oak and alder, and those not always. 3. The stoppage of the leaves (the lungs) of the plant by soot. Not being able to breathe fresh air it cannot perfect its juices.

Gossip.

◆

We have to record the decease of Mons. Jean Baptiste Biot, the eminent French chemist, and the father of the Academy of Sciences at Paris, which happened on Tuesday last at the age of eighty-eight. Born in 1774, he early devoted himself to the study of chemistry and natural science, and owing to his great proficiency, was elected into the French Academy so far back as 1803, when less than thirty years of age. The father of modern science in Paris, and beloved by all who knew him, M. Biot's life has been singularly uneventful; only a year ago he was described as being still as devoted to his favourite pursuits as ever, and as having recently contributed to "Les Annales de Chemié," an introduction to some "Researches in Mechanical Chemistry, in which Polarized Light is employed as a re-agent by way of an Auxiliary." He has also experimented on solutions of various tartars, and in the "Annales" gives accurate and interesting tables of results. M. Biot's death will cause in Parisian society a void which will not readily be filled up.

Captain Norton has written us a letter in which he vindicates the system of filling up enemies' harbours with stones. "It appears to me," says he, "to be mere cant on the part of the *Times* and other papers pretending to condemn such practices, when our noble selves have given War Office commands to do the same thing." He enclosed two extracts, one was a letter from Lord Hobart to Sir A. S. Hammond, Feb. 9, 1804, authorising the latter to block up the harbour of Boulogne, by sinking vessels filled with stones and other material. The other extract says, "That on the evacuation of the city and port of Alexandria, and embarkation of the troops, in the year 1807, five vessels laden with stones were sunk in the narrow passage by which our squadron, under the command of Admiral Lewis, had entered, and then sailed, concluding that it would be the last exit of any vessel from the port—erroneously, however, as it has subsequently appeared."

Mr. George Wilkinson, the Master Cutler of Sheffield, has taken Mr. Roebuck and the other speakers at the public meeting referred to in our last, to task, for asserting that Sheffield will be behind Germans, and Rhenish Prussians, at the coming Exhibition. "If Sheffield," says Mr. Wilkinson, "does not make the appearance in the Exhibition that it might do, it will be from no falling off or fear of competition, but from the miserably small amount of space allotted, a considerable number of our first-class manufacturers declining to exhibit, in consequence of the inadequate space afforded them. I have been connected with the cutlery trade for the last thirty-five years, and have had ample opportunity of judging of the progress made in other branches. I can, with perfect confidence, assert that there is no falling off in the productions of Sheffield; on the contrary, great progress has been made not only as regards quality, but artistic design also, more especially since the Great Exhibition of 1851. It is quite true cheap goods are made in Sheffield, which must necessarily be the case, in order to supply the demand where better class goods cannot be purchased; and no doubt many inferior goods are also made. This is not what the manufacturers of first-class articles complain of, but the abominable practice of foreign manufacturers stamping the names and corporate trade marks of such houses upon their wretched imitations, and foisting them upon the world as genuine Sheffield goods."

On Tuesday last, the commissioners appointed to report on all plans for embanking the Surrey or southern side of the river Thames met at the offices of the commission, in Victoria street, Westminister; the Right Hon. the Lord Mayor in the chair. Present: Major-General Sir J. Jebb, Captain Galton, R. E., Commander Burstal, and Mr. H. Kingscote. The commissioners, who have about twenty plans before them from civil engineers and others, had two under consideration during the sitting. The first plan submitted and explained was that of Mr. J. Carter, C.E., who built the sea wall at Guernsey, and other works in the colonies. He proposed an embankment wall on a solid base from Lambeth new bridge down to Deptford, 100 feet wide, upon arches all along, and over these a railway, consisting of a double line of rails, uniting with the various railways on the southern side of the water, with tramways for the convenient interchange of traffic between north and south by means of the railway bridges now being carried across the river. Combined with the railway on either side he would have a roadway and promenades on either side. Underneath the embankment, which would be on a level with all the bridges, he would have a continuous line of arches 50 feet wide, for the storage of coals and merchandise. The estimated cost of the entire structure between Lambeth and Deptford, about five miles, would be £75,000 per mile. Mr. F. W. Shields, C.E., whose plan for the northern embankment of the Thames was specially recommended by the commissioners in their report to Parliament last session, deposed that he did not propose an embankment to be constructed between Southwark and Westminster bridges, but only a fixed line of river boundary corresponding with the abutments of the bridges, with a general line of wharf frontage. Above Westminster-bridge he proposed an embankment in a straight line to new Lambeth-bridge, and extending considerably in shore, so as to leave a large portion of reclaimed ground between the river boundary and existing wharves, on which shops and villa residences might be built. From new Lambeth-bridge the embankment would be continued by an easy curve to the abutment of Vauxhall-bridge, but he proposed, for the present, to construct it for only half that distance, stopping short of the gas-works and other premises. Along the river side of this embankment a road 80 feet wide would be carried, and at Vauxhall-row, adjoining Vauxhall-bridge, continued and extended to meet it, so as to give a spacious and direct thoroughfare between the bridges of Westminster and Vauxhall. The commissioners then adjourned.

The Atlantic Telegraph Revived.—There is reason to believe that attempts will shortly be made to connect England and America once more by the electric telegraph, and this time with greatly increased prospects of permanent success. Recent occurrences have impressed the Governments of England and the United States with the enormous importance of such a means of communication, and it is not too much to say that, had an electric telegraph existed between the two continents, the affair of the Trent would not have been attended with those serious apprehensions which we have witnessed; would have saved the vast expenditure which our Government incurred; would have prevented the depreciation of property in both countries to the amount of millions, and that interference with commerce and manufactures which resulted from the ill-judged and unauthorized conduct of Captain Wilkes. The President and Government of the United States are so fully sensible of the importance and value of telegraphic communication, and of the possibility of providing it, that they have decided upon giving every support in their power to any well-considered project of that kind. The Government of the United States have, in the most liberal manner, offered to subscribe one-half of the sum which would be required for making the cable, and give the use of vessels of their navy in assisting to lay it, provided the British Government will grant the remaining portion of the sum. Mr. Cyrus Field, who took so active a part in reference to the former Atlantic telegraph, has, we are informed, undertaken a mission to this country for the purpose of inducing the British Government to act in a spirit of equal liberality, and co-operating with this friendly offer on the part of the United States. As further evidence of the friendly spirit which has actuated this offer, the Government of the United States are perfectly content that the telegraph should have its terminus on British territory, as that will afford the nearest point of communication with England or Ireland. Any arrangements that would be entered into between the two Governments would, of course, provide for the efficient working and use of the line, and would guarantee its protection by both countries in the event of hostilities. We are at a loss to see upon what grounds our Government can refuse to respond favourably to the offer, which, if not already made, will shortly be submitted to its consideration. The cost of the cable, calculated with the greatest amount of care, and with every improvement, would not be greater than that which was expended on the line from Malta to Alexandria, and which was wholly defrayed by the Government. Our interests with the American continent are not less important than those with India; and, even if greater importance were to be attached to our Eastern possessions, it would only render still more necessary a line across the Atlantic, seeing that, with the telegraphs which already exist on the American continent, and which now extend to the Pacific coast, it would afford a means of rapid and valuable communication from the west with China and our Indian empire.—*Observer.*

Locomotive Statistics.—In working the trains on the Manchester, Sheffield, and Lincolnshire Company's line during the half-year ending the 31st of December last the locomotive engines were in steam 180,881 hours, of which 91,083 were occupied in running, 61,636 in shunting, and 25,142 standing. The engines consumed 61,837 cwt. of coke and 439,238 cwt. of coal. The cost of fuel per hour was 16·82d., and per mile 1·90d. The train miles run by the engines amounted in the aggregate to 1,267,299; in assisting trains, 13,436 miles; and in conveying empty trains, 79,246 miles; making the total miles run by the engines during the half-year 1,379,981. The number of passenger trains run during the half-year was 26,477, of which 17,339 arrived in time, and 9,138 above five minutes after time. The number of goods trains run was 8,901, of which 5,304 arrived in time, and 3,597 above five minutes after time; and the number of coal trains run was 7,405, of which 5,186 arrived in time, and 2,219 above five minutes after time. The average number of carriages in the passenger trains was 6¼, of waggons in the goods trains 36½, and in coal trains 25¼.

The Consumption of Sugar in France.—The *Recueil des Documens Commerciaux et Financiers* contains a very interesting statement relative to the consumption of sugar in France since 1841. The consumption of sugar in France in the year 1841 amounted to 100,964,047 kilogrammes. In 1860 it increased to 201,462,864 kilogrammes; and in 1861 it reached 247,998 kilogrammes. In 1841 the colonial sugar imported into France amounted to only 74,514,503 kilogrammes. In 1860 the importations increased to 115,168,242 kilogrammes. It declined in 1861 to 113,205,800 kilogrammes. The foreign sugar imported into France in 1841 amounted to only 12,042,268 kilogrammes; it increased in 1860 to 46,679,500 kilogrammes, and in 1861 to 85,229,300 kilogrammes.

Ventilation of Coal Mines.—We understand, says the *Mining Journal*, that through the influence of Mr. T. Young Hall, of Newcastle, experiments will be made at Montague Main Colliery, Scotswood, with a view to test the value of Mr. Charles Colwell's system of ventilation by *propulsion* instead of *suction*. Mr. Colwell anticipates that by changing the system of ventilation from *traction* to *propulsion* he will be enabled to render several million cubic feet of deleterious and explosive gas harmless, and in writing of the intended experiments says:—"I have seen the pit, or rather its present arrangements, the work being stopped at this moment; and should the owner's consent be obtained, as it doubtless will be, it would require but a few hours' preparation, and that at a cost only of a few shillings, to determine whether colliery explosions are preventable, as I believe them to be, or that the propositions of your humble servant emanate from the brain of a mad enthusiast. In fact, it is simply a question whether the known law of pneumatics, if applied as ordained by nature, is superior to the various suppositions of those who now appear to reverse the order of natural philosophy in their mode of ventilating collieries."

The *American Gas-light Journal* says that the experiments with water-gas are highly satisfactory. About 73 parts of it are derived from water, and the remainder from oil. The light is said to be of a better colour than coal gas, and in every respect superior. The same journal, in speaking of the "sound condition of gas companies," says:—"While the shares on railroads, banks, and other corporations, exhibit fluctuations in value and an uncertainty as to paying dividends upon their capital stock, the condition of gas-light companies shows a marked contrast. Our foreign exchanges are filled with dividend notices of gas companies; and particularly in England, where the price of gas is very low, the returns are large, and afford a gratifying evidence of the profitable nature of the business, and of the accommodation offered to capitalists in the way of investment."

Mr. Scott Russell's Target.—On Monday last a party of shipwrights were despatched from Chatham Dockyard to Shoeburyness, to be employed in erecting a target faced with iron armour-plates fastened together without bolting, on the principle recommended by Mr. Scott Russell. The armour-plates, which are of the same thickness as those for the Achilles and Royal Oak, have been prepared at Chatham Dockyard, where the target has been put together, the plates being of different sizes, with the edges prepared according to Mr. Russell's directions. The experiments with the elongated Armstrong shot upon this target, and their effect on the iron plates, are looked forward to with some interest, as, should the Admiralty decide on adopting the plan recommended by Mr. Scott Russell, the whole of the armour-plates for the iron ships building will require to be altered. The Dove, Admiralty transport, shipped the remainder of the plates and the scaffolding for the target yesterday afternoon, and was to sail for Shoeburyness last night.—*Times*.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 1794, 1797, 1803.
Boilers and their Furnaces, &c., *None*.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1780, 1788, 1837.
Ships and Boats, including their fittings, 1811, 1823.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 1767, 1821.
Food and Beverages, including apparatus for preparing food for men and animals, 1779, 1786, 1816.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1766, 1769, 1777, 1787, 1802, 1804, 1805, 1810, 1822, 1832, 1838.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1773, 1775, 1835, 1839, 1842.
Lighting, Heating, and Ventilating, 1789, 1793, 1795, 1834, 1841.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1768, 1771, 1778, 1782, 1784, 1791, 1799, 1801, 1807, 1808, 1812, 1813, 1826, 1827, 1828, 1833, 1836.
Metals, including apparatus for their manufacture, 1774, 1792, 1817.
Chemistry and Photography, 1770, 1772, 1776, 1783, 1785, 1790, 1819.
Electrical Apparatus, 1800.
Warfare, 1781, 1814, 1824, 1825, 1831.
Letter-Press Printing, &c., *None*.
Miscellaneous, 1798, 1809, 1815, 1818, 1820, 1829, 1830.

1766. F. Tolhausen. *Improvements in looms for weaving ribbons and other fabrics.* (A communication.) Dated July 13, 1861.

Here the object is to afford the means for using in a practical way a greater number of shuttles than heretofore, and thus weave fabrics of greater variety and richness of colour; and also to obtain the shuttle motion by a single "marionette" or shuttle driver, instead of using one material for each shuttle, which is a source of much trouble in fancy weaving. Thus, by substituting one single material, or rather a marionette carrier, an indefinite number of shuttles may be used. *Patent completed.*

1767. T. Smith and G. Taylor. *Improvements in horse-rakes and cultivators, and in wheels for the same and other carriages.* Dated July 13, 1861.

Here in constructing horse-rakes, in addition to the tines being all independent of each other, the central tines are arranged so that they may be set suitably to descend lower down than the other tines, in order that such central tines may, when desired, work in a furrow when the rake is being moved along the same, whilst at other times, when the rake is on level land, the central and other tines, as heretofore, may be caused to work at the same level. For this purpose the tines may be mounted on a cranked axle, the crank occupying so much of the central portion of the length of the axis as is required for the central tines which are desired to descend lower than the other tines. *Patent completed.*

1768. T. Woycke. *An improvement in the manufacture, construction, and production of the heels and the uppers immediately above the heels of boots and shoes, for imparting durability and permanency of form to the said heels and uppers.* Dated July 15, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

1769. E. Briggs and S. Fearnley. *Improvements in the manufacture of piled fabrics, and in the machinery or apparatus employed in manufacturing piled and other fabrics.* Dated July 15, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1770. T. Walker, jun. *Certain improvements in apparatus for polarising light, applicable to microscopes and other optical instruments.* Dated July 15, 1861.

This consists in the application of glass placed at certain angles in a suitable frame for polarising light. *Patent abandoned.*

1771. G. Tarble. *An improvement in show-cases.* Dated July 15, 1861.

This invention consists in constructing cases for showing jewellery, chemists' articles, specimens and articles generally, with a sliding cover of glass bent into the segment of a circle fitted in a correspondingly-shaped frame, and free to be worked from the back or front of the case. The frame carrying the glass moves in grooves in the side of the case. *Patent abandoned.*

1772. T. Cobley. *Improvements in the manufacture of metallic and earthy silicates or siliceous compounds of the same from the metallic and earthy bases of their salts and soluble alkaline silicates, the formation of alkaline acetates or caustic alkalines, and application of the same.* Dated July 15, 1861.

This consists in a method of forming silicates of lead, zinc, copper, baryta, or any other base silicifiable, by treatment with soluble alkaline silicates. *Patent completed.*

1773. T. Cobley. *A process for preserving and indurating timber, wood, and other vegetable matters, and for rendering the same non-inflammable.* Dated July 15, 1861.

Here a strong solution of potash, baryta, lime, strontia, or any of their salts, or of the salts of any metallic or other base capable of forming an insoluble compound with hydro-fluo silica acid, is forced into the timber, wood, or other vegetable matter to be acted upon by hydraulic or other means, and this process is repeated until the wood, &c., is sufficiently charged or impregnated with the solution to enable it to withstand the influence of flame. After the impregnation has been thoroughly effected with any of the given solutions, hydro-fluo silicic acid is forced into the wood, &c., by analogous means, with a view to render the solutions insoluble. *Patent completed.*

1774. R. Taylor and T. Price. *Improvements in the manufacture of tin and terne plates.* Dated July 15, 1861.

The patentees claim the use and application in the manufacture of tin and terne plates of a pair of rolls to work immersed in a vessel containing the melted tin or terne metal, and so arranged within the same that the line joining their centres or the line of pressure, shall be placed just so far above the surface of the melted tin or terne metal that, in passing the plate, along the guides, and between the moving rolls, the metal shall not rise on the plate above the point where it is in contact with the surface of the roll as set forth. *Patent completed.*

1775. J. C. Coombs and J. Wright. *Improvements in the manufacture of pottery, porcelain, and other ceramic and plastic wares, also in the method of, and means for, preserving stones, bricks, and such like materials.* Dated July 15, 1861.

The patentee claims the application of fluo-silicates and artificial silicates of the alkalies, alkaline earths, and other earthy bases to the manufacture of glass, pottery, porcelain, and other ceramic and plastic wares, and more particularly the substitution of the fluo-silicic salts, and other earthy bases, for the phosphoric compounds of the same or other bases in the manufacture of glass, pottery, &c. *Patent completed.*

1776. T. Cobley. *A process for the production or manufacture of fluo-silicates of tin, zinc, and baryta, and their application as pigments for glazing, enamelling, and in the manufacture of glass.* Dated July 15, 1861.

In carrying this invention into effect the patentee proposes to form fluo-silicates of tin by dissolving the oxide of tin in fluo-silicic acid, or by decomposing a solution of a salt of tin by means of fluo-silicic; or if a silicate of tin, he acts upon it by means of fluoric acid and forms the fluo-silicate. He then treats the fluo-silicate thus formed with sulphide of ammonium, or sulphuretted hydrogen, so as to produce a sulphide. This sulphide he proposes to apply as a pigment or glaze or enamel in the manufacture of porcelain, either in combination with lead, or separately, as the case may be. He proposes to form the fluo-silicate of baryta in the manner stated in his patent (No. 1732), Dated 8th July, 1861, but, in addition to the manner there described, he proposes also to form it by acting upon silicate of baryta, either native or artificial, with fluoric acid. He proposes to apply this fluo-silicate of baryta, either with or without the fluo-silicates of zinc, as a substitute for lead in the manufacture of glass, or as a pigment or enamel in the manufacture of porcelain. He also proposes to apply it in the same manner in combination with fluo-silicate of tin. He proposes to form fluo-silicate of zinc by dissolving the oxide of zinc in fluo-silicic acid, or by precipitating a solution of a salt of zinc by the addition of the chemical equivalent of the said acid. He then collects the precipitate, and dries the same in any convenient way. When he can obtain a silicate of zinc, either natural or artificial, he treats it free from iron with an equivalent of fluoric acid, and forms a fluo-silicate. In this way, instead of using the fluo-silicic acid, he proposes to use the fluo-silicate of zinc as a glaze or pigment or enamel, either with or without baryta. One of the chief applications, however, which he proposes, is as a substitute for lead in glass manufacture, and he uses it either alone or in combination with baryta, by means of which he is enabled to produce a glass possessing peculiar optical properties, that is far more free from veins and striæ than glass as ordinarily made. *Patent completed.*

1777. B. Browne. *Improved machinery for clearing and smoothing spun thread or yarns and other similar fibrous materials.* (A communication.) Dated July 15, 1861.

This invention is carried into effect as follows:—In a suitable framing a quantity of bobbins or creels containing thread or other spun material, are placed loosely on pins or studs; the thread is passed thence over and against suitable guide rollers, and twisted once round each of a series of small loose spindles or rollers mounted one over the other on a sliding frame or box; thence the thread passes around, between, and over other rollers to another roller, on to which it is wound in a finished state. The aforesaid sliding box or frame of small rollers has vertical reciprocating motion imparted thereto from a lever and friction wheel adjusted to the lower part of the framing of the machine. The axis of rotary motion of this said friction wheel is a pin passed through the upper end of a bell crank lever; the axis of vibration of the said lever is a pin or stud fixed to the framing of the machine, and to the lowermost arm of said lever a spring is affixed, the elastic force of which causes forced contact of the periphery of the friction wheel aforesaid, which is covered with leather, against the periphery of another wheel or long drum, which is mounted and revolves in suitable bearings, and is driven by a steam engine or other motive power. A similar arrangement of parts, in connection with a friction wheel operated upon by the aforesaid drum, is employed at the opposite side of the machine, so that the operator, by simply pressing his foot on the lower arm of the bent crank lever aforesaid, draws one or other of the friction wheels out of contact with the driving drum, and thus stops the action of the clearing or smoothing mechanism, which is in connection with each friction wheel. It is proposed to employ a separate set of clearing and smoothing rollers to each bobbin at each side of the machine. The foregoing arrangement is susceptible of various modifications—for example, instead of imparting reciprocating motion to the sliding frame or box containing the series of small rollers before mentioned, the said rollers may be attached to the upper part of a vibrating arm for clearing and smoothing the yarn, the said arm being furnished with a series of the loose small rollers before mentioned over and around which the yarn passes. *Patent completed.*

1778. A. Topham, J. Topham, and J. Topham. *Improvements in the manufacture of lace.* Dated July 15, 1861.

For the purposes of this invention, in order that holes of any desired length may be produced in lace which is being made in a lace machine, and that such holes may be caused to be inclined to, or be at angles to the back edge or the line of salvage of a breadth or piece of lace, an extra thread or threads, properly weighted, is or are used, which are caused to be linked in or attached to the lace which is being made in the machine, and at a distance from the threads, which, for the time being, are producing the parts of the lace which bound or are next to the part where a hole is being produced, and such extra thread or threads are caused to link in with a bobbin or bobbin threads working or forming the sides where the hole is being produced, by which a bias or drag is induced towards the point where the extra thread, or the points where the extra threads are attached, so that, in place of the hole being made straight down in the lace, the lace or fabric where the hole is being produced will be progressively dragged by the extra thread or threads towards the point or points where it or they are attached. And in order that the hole should not be dragged open or expanded, and to obtain at the sides of the hole an appearance of an internal purl by such extra thread or threads, another extra thread is used as a lacing thread by which the two sides of the hole are drawn towards each other, and produce the appearance of an internal purl. *Patent completed.*

1779. J. H. Johnson. *Improvements in machinery or apparatus for cleaning rice.* (A communication.) Dated July 15, 1861.

This invention relates to a peculiar construction and arrangement of machinery or apparatus for cleaning rice; and consists in the application and use for that purpose of wire gauze or per'orated plates, and chambers or cases, in combination with detachable and adjustable stone blocks, the blocks and wire gauze, or perforated metal surfaces being so shaped and disposed, that, when combined, they will form a hollow cylinder or cone, in the interior of which revolves any suitable drum or beater. The wire gauze or perforated plates may either be introduced between the continuous edges of the stones, or inserted into the stones themselves, which, in that case, are cut away to receive the chamber of which the wire gauze or perforated plates form the inner surface. The object of these cases or chambers is to allow of the free escape of the meal, which, after passing through the wire gauze or perforated plate or plates, is removed or carried off from the chambers by tubes or spouts to a proper place of deposit. The same object may also be obtained by inserting crosswise at intervals within the length of one or more of the stones sections of wire gause, wire cloth or perforated plates, leaving open spaces behind, so that the meal may be withdrawn at intervals, or as fast as it is formed. *Patent completed.*

1780. J. T. Gossel. *Improvements in railway carriages.* (A communication.) Dated July 15, 1861.

This express railway carriage (so called by the inventor), differs from the ordinary railway train, in so far that it is a combination of the three principal parts of an ordinary train, and includes in one body, and mounted upon the same framing, a locomotive engine, a tender to carry water and fuel, and a carriage or compartments to receive a limited number of passengers. The whole of the carrages will not exceed 25 feet in length. *Patent abandoned.*

1781. W. Rigby. *Improvements in the manufacture of armour plates for defensive purposes.* Dated July 15, 1861.

This consists in manufacturing and shoping such plates, 1, by the process of hammering, as is well understood, and having reduced them to a suitable thickness, finishing the same by rolling them down in rolls the thickness required, so as to impart a fibrous character to the iron composing the same. *Patent completed.*

1782. J. Mabson. *Improvements in sewing machines, particularly applicable to quilting and braiding.* Dated July 15, 1861.

The inventor proposes attaching to sewing machines a bent arm or cloth presser, in which is a hole for the needle to pass through, and close to this hole is an opening or loop which serves as a guide for the braid. Upon the end of the cloth presser is attached a cross piece, which can be adjusted by sliding feet to any desired width for quilting, and this acts as a gauge, preventing any irregularity in the width to be quilted. The foot sides travel on the quilting gauge, and are secured thereon at the required distance apart by small thumb screws. *Patent abandoned.*

1783. E. G. F. De La Provotais. *Extracting the fibres from genista scorparia (broom) and other application to manufacturing paper and fabrics, and also treating the washing waters so as to obtain dyeing products therefrom.* Dated July 15, 1861.

The patentee claims, 1, preparing ligneous fibres from genista scoparia (broom) for the manufacture of paper, pasteboard, and also of fibres intended to be converted into fabrics. 2. Colouring products from the washing waters remaining after the treatment of the fibres. *Patent completed.*

1784. W. Clark. *Improvements in stage scenery and apparatus.* (A communication.) Dated July 15, 1861.

This relates to the production on the stage of a theatre of scenic effects closely imitating nature, so as to facilitate and increase the illusion of the spectator. The inventor dispenses with the drapery skys that are usual, single vanishing point, and the side scenes. He also makes the sky of spheroidal form, to which motion may be imparted, and susceptible of producing the most varied luminous effects. This invention is not described without reference to the drawings. *Patent completed.*

1785. J. Mapple *Improvements in telegraphic apparatus.* Dated July 16, 1861.

This consists of an endless chain rotated by a train of wheels, and in its rotation it is made to rub against an inking roller supplied with common printing ink, and the strip of paper is pressed against the inked surface of chain by the attractive force of an electric magnet, which is common to all the morse telegraphs. *Patent abandoned.*

1786. J. Gotcher. *Improvements in stacking corn and other crops.* Dated July 16, 1861.

This invention consists in stacking corn in such manner as to leave a passage or passages up through the stack for the circulation of air. The inventor prefers to form a hollow or skeleton frame, upon and against which the corn or other crop is stacked, and to fix the foundation frame at a distance from the ground to allow of free circulation of air under and up through the stack. *Patent abandoned.*

1787. J. S. Wells. *An improved needle, used in the manufacture of looped fabrics.* Dated July 16, 1861.

This needle differs from the common bearded needle in the following respects. In place of the long beard which is depressed by a presser which forms part of the machine or frame in which the common needle is used, the inventor proposes to use a needle having a much shorter beard; or he makes the needle to terminate in a hook. For the eye he uses a slot made quite through the substance of the needle, and in this slot he inserts a small piece of metal having a groove in its upper surface which receives the end of the beard or hook. *Patent abandoned.*

1788. J. Blinkhorn. *Improvements in machinery or apparatus for working railway signals.* Dated July 16, 1861.

This invention is carried into effect in the following manner:—The patentee joints to the permanent way or rails, at any desired positions, a number of levers in connection with other levers partly under the said permanent way or rails, and partly on one side, at a little distance from them. The levers jointed to the rails are inclined upwards, so that, when an engine, train, or carriage, passes over them, they will descend, and act upon two projecting arms, which, acting on other levers, cause the release of a chain, wire, or other connection, fixed to a balance lever attached to the semaphore, and cause the signal to be raised, which is afterwards held as long as required, by a catch. At any suitable distance from the aforesaid levers he joints other levers to the permanent way or rails for giving motion to a chain wheel connected by a chain, wire, or other means, with another chain wheel employed for operating upon the catch which holds the signal in its raised position, so that when the engine, train, or carriage, passes over this second apparatus, the signal is released and falls. For better protection in cases of engines or trains closely following each other he employs a supplementary catch, so that, if an engine or train passes the semaphore before the first one shall have passed the releasing apparatus, the supplementary catch shall prevent the signal from falling before the second engine or train has arrived at the releasing apparatus, or, in fact, holding the signal in the same position until any number of carriages or trains have arrived at the releasing apparatus. It is evident that, when working, the signal or bell may be struck at the same time, or the apparatus may ring a bell, or give any other signal that may be found requisite. *Patent completed.*

1789. R. Jones. *Improvements in safety lamps.* Dated July 16, 1861.

This consists in fitting safety lamps internally with a metallic cap or extinguisher jointed or hinged in close proximity to the wick or flame, the lower or hinged portion thereof being tapped for the reception of a screw which passes through the same, so that upon turning the said screw in the direction necessary for locking the lamp, the cap or extinguisher is thrown back from the wick or flame, whilst, upon turning the same in the opposite direction for unlocking the lamp, the cap or extinguisher is caused by the friction of the screw passing through the joint of hinge to be brought forward and descend upon the wick or flame, and remain in that position whilst the screw is being withdrawn from the said hinge for effectually extinguishing the light. *Patent completed.*

1790. J. P. Gillard *Improvements in the manufacture of soda, carbonate of soda, and hydrochloric acid.* Dated July 16, 1861.

These improvements in the manufacture of soda, carbonate of soda, and hydrochloric acid, consist in submitting common sea or rock salt (chloride of sodium) in a suitable retort to a high temperature, and projecting at the same time on the salt in the retort jets or streams of superheated steam, hydrogen gas, carbonic acid, or carbonic oxide gas, or suitable combinations, of either two or more of the said gaseous fluids, by which means the decomposition of the salt will take place, and hydrochloric acid be evolved, which may be drawn off from a proper condenser connected with the decomposing retort, whilst, according to circumstances, either soda or a carbonate of soda will be left behind in the retort. For superheating the steam or the other above-mentioned gaseous fluids, the inventor causes them to pass through tubes formed of a suitable alloy of platinum and iridium, which tubes are inserted in a proper superheating furnace, one or more layers of wire cloth made of the same iridized platinum being situated in the interior of the said tubes, through the meshes of which wire cloth the fluids to be superheated are obliged to pass before reaching the decomposing retort. *Patent abandoned.*

1791. D. Holden, Jun. *Improvements in foot and kneeling stools.* Dated July 16, 1861.

The inventor furnishes these stools with two or more surfaces or faces, and mounts them on axes; whereby either of the faces can at pleasure be presented for use. *Patent abandoned.*

1792. C. D. Abel. *Certain new alloys of silver with other metals, and the processes employed in their manufacture.* A communication). Dated July 16, 1861.

The patentee claims: 1, the use of ferrocyanide, or ferricyanide of potassium, for the purification and reduction of the nickel used for such alloys; 2, the use of a galvanic current in the purification and reduction of the nickel for aiding its solution, and for operating its precipitation; 3, the use of ferrocyanide of potassium, or of ferricyanide of potassium, as fixed or reducing agents in the formation of the alloys; 4, the introduction of manganese into the alloys; 5, the introduction into, and, when required, the subsequent elimination of phosphorus from the alloys. *Patent completed.*

1793. W. Palmer. *Improvements in lamps.* Dated July 16, 1861.

This consists in constructing the cupped pistons or plungers of presser lamps of a composition of glue and treacle, melted and cast in moulds, such pistons or plungers being of like form to the cupped leather pistons or plungers heretofore used; also, in using a like composition in the manufacture of washers for those parts of pressure tanks, which require to be made fluid-tight. *Patent completed.*

1794. A. W. Harnett. *The improved construction of steam engines, air engines, and pumps.* Dated July 17, 1861.

The inner surface of the cylinder, and the outer surface of the piston and piston rod all or either of them are, according to this invention, to be formed, by any mode of rifling, as to cause to be imparted to the piston a spiral movement when in motion. *Patent abandoned.*

1795. J. H. Butterworth. *An improved mode of, and apparatus for, heating water or other fluids.* (A communication.) Dated July 17, 1861.

This invention relates to the novel employment and use of a metal or alloy fusible at a low temperature, for the purpose of retaining heat imparted thereto by fire and air, applying the heat so obtained for the heating of water or other fluids. The apparatus consists in a vessel or receptacle furnished with an arrangement of internal tubes, similar to a multitubular boiler, around which the fusible metal is disposed, and is heated to produce heated water in the tubes, and which when once in a state of fusion, may be kept heated at a minimum consumption of fuel. The water to be heated is circulated through the tubes, and becomes either generated into steam, or simply heated, as may be required; the object being to economise fuel by maintaining the heat once sufficiently obtained to liquify the metal by keeping such molten metal at a certain heat around the water tubes, which may be effected by a small amount of fuel. *Patent completed.*

1796. J. H. Butterworth. *An improved mode of, and apparatus fop heating water, and other fluids.* (A communication.) Dated July 17, 1861.

This invention relates to the novel employment and use of a metal or alloy fusible at a low temperature, for the purpose of retaining heat imparted thereto by fire, and in applying the heat so obtained to the drying of any suitably required material. The apparatus consists in a vessel or receptacle furnished with an arrangement of internal tubes, similar to a multitubular boiler, around which the fusible metal is disposed, and is heated to produce heated air in the tubes, and which when once in a state of fusion, may be kept heated at a minimum consumption of fuel. The air thus heated is forced by means of a blower or fan into the desiccating chamber or chambers, which are provided with metallic cloth carriers to convey the substance under operation through the chamber. The chambers are provided with an inclined bottom to facilitate the escape of aqueous vapours, beneath which the heated air is admitted, and the chambers may be connected by flexible or rigid points. or otherwise arranged, the object being to economize fuel by maintaining the heat once sufficiently obtained to liquify the metal by keeping such molten metal at a certain heat around the air tubes, which may be effected by a small amount of fuel. *Patent completed.*

1797. J. Parker, J. Walls, and B. Wells. *Improvements in steam-engines, boilers, furnaces, and apparatus applicable thereto.* Dated July 17, 1861.

The object of this invention is to obtain a more efficient or effective force of steam when applied as a motive power, or to economise the working of steam-engines, and, consequently, to effect a saving in fuel; also to promote a better combustion of the gases. The invention consists in constructing the cylinders and pistons in such manner as to avoid dead points and friction, and to balance the pistons when in motion. Two or more cylinders of unequal diameters are cast together, side by side, opening to each other, with stuffing-box covers at each end. The pistons are of diameters equal to the interior of the smallest cylinder, and of the same lengths as the interior lengths of the cylinders. The piston of the small cylinder has a longitudinal groove of suitable size and form to receive a corresponding longitudinal feather, tongue, or projection formed on the other piston or pistons when their surfaces are placed together, and caused to roll in contact with each other in the cylinders. The piston-rods or axes pressing through the stuffing-boxes are geared together outside by equal wheels. The feather or tongue is made to project from the body of the piston, according to the area required for steam in the cylinder. Steam is admitted to the larger cylinder through a double-action conical equilibrium valve at one junction of the cylinders, where it acts upon the feather, tongue, or projection, causing the piston to rotate thereon, and is exhausted at the other junction, from which it mey be condected to another similar cylinder and piston to act in like manner, and thence by means of a bracket-wheel returned to the lower part of the boiler. The ends of the pistons are received, and projections are formed in the covers to enter therein, leaving space for steam on the inlet side to balance the piston. Tubes are placed in the boilers opening at each end of the fire-bed, and arranged in such a manner as to cause the most intense heat of the fire to circulate therein, to accelerate the generation of steam, and jets of steam may be introduced to promote circulation of the heat or flame. The door frames, dead plates, and fire-bars are made hollow, for the passage of atmospheric air to the furnace, to promote combustion of the gases; such hollow grate bars, by preference, are made in two parts. *Patent abandoned.*

1798. J. Mason. *An improvement or improvements in metallic pens.* (A communication.) Dated July 17, 1861.

The nibs of the pens made according to this invention are angular at their upper or back parts, that is, in cross section through the middle piercing; the pen is made up of four planes inclined to one another at obtuse angles. The two middle planes pass into a curve as they approach the point of the pen, and the two outer planes may either extend only to about the middle of the nibs, or nearly to the point of the pen. In each of the side planes two or three side piercings are made in a direction nearly at right angles to the slit of the pen. By means of the side piercings the rigidity which would otherwise exist in the nibs is avoided, and those parts of the said nibs which yield in writing are very nearly or quite flat. By the general figure of the pen it is enabled to take up a large quantity of ink, while the side piercings described prevent the rigidity which would otherwise result from its figure, and enable the nibs to yield readily under pressure. *Patent completed.*

1799. C. E. Redfern. *Improvements in the construction of locks, and adaptation thereof to various useful purposes.* Dated July 17, 1861.

This invention consists in constructing locks in the following manner, that is to say: The inventor forms a shallow circular case of metal, say, of three inches diameter, and half an inch deep. He also forms a parallel opening about three quarters of an inch wide, radiating horizontally from the centre of the said case. Into this case he fits loosely a corresponding shaped piece of metal, in which is adapted a spring bolt of novel and peculiar construction, in the form of a bell-crank lever, one of the arms of which is formed curved, and the other straight; the end of the bent arm has a hole formed through the same, which passes over a stud formed in the second-named case, the said stud being the fulcrum of the spring bolt. There are notches made in the said bolt at the angle or bend thereof, and projecting pieces formed in the first-mentioned or outer case for the notches on the bolt to catch against, to prevent the lock being opened by any other means than its proper key. *Patent abandoned.*

1800. Sir W. O. S. Brooke. *Improvements in apparatus for suspending and insulating electric telegraph wires.* Dated July 17, 1861.

For the purposes of this invention, in order that electric telegraph wires may be insulated where they are supported the apparatus is formed in the following manner: An inverted cup or hollow vessel, by preference of cast iron, and of a rectangular form, is used, the upper end of which is closed, and has formed on it a recess suitable for receiving and having a wire fixed therein by solder or by clamps of hardened india-rubber, prepared wood, or other material. The edges of the sides at their lower ends are turned up into a trough or gutter-like form; on the interior of this inverted cup or hollow vessel is fixed another hollow inverted cup, or vessel composed of the hard compound produced by combining india-rubber and sulphur, and submitting the same to high temperatures. This inner cup or hollow vessel is of like section to the outer cup or vessel above-mentioned, but of less dimensions, so as to leave a space in all directions between the inner and outer cups or hollow vessels, and such space is filled up with melted sulphur. This apparatus is placed on an upright pin or support, by preference of wrought iron, though other material may be used, and such pin or projection is of like section to the interior of the inner inverted cup or vessel, but of different dimensions, so as to leave a space in all directions between the pin or support and the interior of the cup or vessel which is filled with melted sulphur. The pin or support is carried by a bracket, or post, or other suitable means. *Patent completed.*

1801. Sir J. Hare and B. Russ. *An apparatus for heating cylinder-irons or heaters to be used for pressing the seams of garments, finishing of hats, or other purposes, for which heated irons are ordinarily used.* Dated July 17, 1861.

According to this invention, the inventors propose employing a metal chamber of suitable form, through the end of which the gas pipe passes; the iron which is made hollow, or cylindrical, passes in at the end of the chamber through a hinged door or flap, which door is closed when the iron is in its place; the gas is now turned on by a tap close to the chamber until the iron is sufficiently hot, when, by withdrawing it through the door or flap, a lever is caused to fall, by the door coming in contact with it, which turns the gas almost out, leaving but a very small flame, until the iron is returned to the chamber; the gas is then again turned on full, passing through a sheet of wire gauze so as to prevent any smoke or soot getting to the iron, all smoke being consumed in a chimney at the further end of the chamber. *Patent abandoned.*

1802. A. V. Newton. *An improved process and improved machinery for obtaining fibres from the stalks or leaves of fibre yielding plants.* (A communication.) Dated July 17, 1861.

The object of the first part of this invention is to obtain directly from stalks, or leaves of fibre-yielding plants, the fibres in the white state, and of full strength. To this end the fibres are separated from extraneous matter of the stalks or leaves (which have been cut from the plants before the sap has ceased to flow through such stalks or leaves, and while they are yet in the green state) by breaking, beating, scraping, or combing, or by other like mechanical operation, the extraneous matter being removed from the fibres whilst the fibres are protected from the action of the colouring agents by the presence of water or other equivalent fluid, which will prevent the extraneous colouring matter of the plant from impregnating the fibres. The second part of the invention consists in an arrangement of mechanism, whereby the stalks or leaves are held firmly and introduced slowly to the action of rapidly moving combs and scrapers, which break through, loosen, and scrape off the extraneous substances from the fibres. When this is effected, then the motion of the feeding mechanism is reversed. The portion so acted upon is by this reverse motion withdrawn, and the other ends of the stalks or leaves are presented in like manner to the action of the comb and scrapers. *Patent completed.*

1803. J. Thuwell. *Improvements in slide valves.* Dated July 17, 1861.

The object of the present invention is to relieve the slide valves (whether employed for the admission of steam or fluids) under pressure from the pressure acting upon the back or top side thereof, which, in the ordinary slide valves, produces greatly increased frictional wear and tear on the working faces, and more especially in locomotive engines, where a great increase of working pressure has from time to time been made. *Patent abandoned.*

1804. S. Tawell. *An improvement in, or addition to the selvages of laces and other woven fabrics.* Dated July 18, 1861.

The present improvement has for its object, to supersede the subsequent operation of hand whipping, and consists in the introduction of a whipping thread by the machinery in the process of manufacture, either by passing the thread spirally round, or backwards and forward, through the holes of the selvage. The fabric thus made may be used plain, or may have any required fulness given to it, by drawing and securing the whipping thread. *Patent completed.*

1805. A. Elliott. *Certain improvements in looms for weaving.* Dated July 18, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1806. C. West. *Improvements in the mode of insulating and covering wire.* Dated July 18, 1861.

In carrying this invention into effect, the inventor uses only the very best South American rubber, not masticated, but in its native state. The inventor states the difficulty he has hitherto had to contend with in using the native rubber, has been from not being able to consolidate it after it has been placed on the wire. This arises from the rubber, in its native state, containing a large percentage of moisture, which prevents its cohesion, even with the use of solvents. He has, however, overcome this difficulty by a very simple and efficacious method. He drives off the moisture in the india-rubber, previous to its being placed upon the wire; this he readily accomplishes, by subjecting the strips or ribbons of pure india-rubber, after they are cut from the bottle, to a process of desiccation or evaporation. The result is that, the india-rubber so treated will, when on the wire, with the aid of solvents, unite with the second coating of rubber, and this again with the third, and so on. The rubber in contact with the wire does not become soft. *Patent abandoned.*

1807. B. Johnson, and W. H. Anderson. *Improvements in pianofortes.* Dated July 18, 1861.

This invention consists in and constructing pianofortes in the following manner, and in adapting thereto certain parts not heretofore employed in their construction: First, the patentees propose to construct pianofortes with a double "belly" or two bellies with perforated sounding posts between them to connect them together; this double "belly" is intended to enclose the "back" of the instrument from front to back thereof, and thus to form an air tight wind chamber, in connection with which are bellows and valves operated upon as hereinafter described. Secondly, they propose to employ three pedals in addition to the two ordinary pedals; one of these extra pedals is employed to cause a swell, and is so arranged as to raise the top of the instrument, or valves placed therein, or both simultaneously. Another of the aforesaid extra pedals is employed for sounding octaves by the performer simply striking one note, the corresponding note necessary to produce an octave being connected to the first-note of the octave by suitable mechanism operated upon by this last named pedal. Another pedal, which they call the very forte pedal, is employed for sounding octaves, raising the top or valve therein, or both; also for taking the damper off the string, and operating the bellows simultaneously. By thus constructing pianofortes the power of the instrument is considerably increased. *Patent completed.*

1808. M. E. Guaymard. *Improvements in the manufacture of shirt fronts, collars, and cuffs.* Dated July 18, 1861.

This invention consists in applying an elastic or resistant stiffening to shirt fronts, collars and sleeves, for which purpose the inventor interposes between two thicknesses of the fabric, or in a fold of the same, a brass wire, suitably silvered or galvanized, which, at the same time that it furnishes a well defined projecting surface, also preserves the shape of the article to which it is applied. *Patent abandoned.*

1809. J. Tillotson. *Certain improvements in the manufacture of pawnbroker's duplicate tickets, and in the apparatus connected therewith.* Dated July 18, 1861.

This invention relates to the application of the well-known process of perforation to the sheets of paper or pasteboard to be employed for pawnbrokers' duplicate tickets, so that the tickets may be readily torn apart. *Patent abandoned.*

1810. P. Williams and T. Parkinson. *Certain improvements in carding engines for carding cotton or other fibrous substances.* Dated July 18, 1861.

This invention consists, 1, in the novel application of one or more rollers beneath the "licker in," such rollers having their surfaces sub-divided by grooves in the line of circumference, and transversely in the line of axis, so as to form teeth or projections thereupon, which act upon the cotton passing between them and the "licker in," in such a manner as to disengage and separate the impurities therefrom, which fall into a receptacle provided for the purpose. 2. The improvements consist in the novel application and use of an extra card roller or cylinder placed before the usual first top card roller, and so driven as to cause it to take the cotton from the main cylinder. The cotton is then taken from the extra roller by the usual first card roller, and fed on to the main cylinder, by which arrangement a fuller separation of the dirt is effected, and the cotton passes thus cleansed through the carding engine as usual. *Patent completed.*

1811. J. H. Johnson. *Improvements in capstans and windlasses.* (A communication.) Dated July 18, 1861.

This invention relates to certain improvements in capstans, and whereby they will operate continuously without stopping or surging. The main drum of the capstan rotates in the usual manner round a fixed stem or axis, secured vertically in a cast-iron bed plate or base, and is rotated in the ordinary, or in any other convenient manner. At the base of the drum is the "float," consisting of an inclined ring embracing the same; this ring turns with the drum, and is kept inclined by resting at one side on a roller or pulley carried on a movable carriage, whilst at the opposite or lower side it rests upon a shoulder formed on the base of the drum. The carriage which carries the roller or pulley is supported upon a circular railway, formed for that purpose round the edge of the base or bed plate, and is provided with a projecting tongue or stop, which serves to keep it in its place, by bearing against one or other of a series of stops or projections in the bed plate. By the aid of the stop on the carriage, it may be placed in any desired position for giving the proper inclination to the "float" or ring upon which the rope rests, the inclination of the ring insuring the free passage of the lowest turn or coil of the rope, and enabling the capstan to be worked continuously without fear of the different coils riding or mounting over each other. *Patent completed.*

1812. G. Coles, J. A. Jaques, and J. A. Fanshawe. *Improved apparatus to be used for brushing and dressing cloth.* Date July 18, 1861.

This invention consists in adapting to machines fo brushing cloth, a roller or rollers provided on their peripheries with elastic ribbed rubbing edges, which, when the rollers are set in motion, will rub, brush, or dress the surface of the cloth. These ribbed rubbing edges are arranged helically round the rollers, but the helical coils commence at or near the middle of the rollers, and are arranged in opposite directions, so that, when acting on the surface of the cloth, they may keep the same spread out or distended in a lateral direction from the centre. The elastic ribbed rubbing edges are made of india-rubber, but the peculiar form, dimensions, and arrangement of these working parts must depend on the nature of the material to be operated upon, and the effect it is desired to produce. *Patent completed.*

1813. J. A. Jacques, and J. A. Fanshawe. *An improved apparatus for a mode of stopping, plugging, or closing inkstands, bottles, and other vessels of capacity.* Dated July 18, 1861.

This invention consists in making the plug or stopper whereby such vessels are closed in the form of a screw made wholly or partly of vulcanized india-rubber, gutta-percha, or some other suitable elastic material. *Patent completed.*

1814. J. W. Rogers. *An improved mode of building ships and floating batteries, applicable also in part to the construction of fortifications.* Dated July 18, 1861.

This consists in methods of combining wood and iron in the building of ships and floating batteries, and in the covering of fortifications, whereby such structures are rendered impervious to shot, and, in the case of floating shot proof structures, their buoyancy is increased, and the invention is based upon the fact that the resisting power of iron plates is greatly increased when set edgewise to receive concussion, force, or weight, as the case may be. *Patent completed.*

1815. R. Walker. *An improved apparatus for stopping and packing bottles.* Dated July 19, 1861.

This consists in substituting for corks a washer or disc of india rubber, or other yielding material, which is either pressed upon the end of the neck of the bottle, or against which the end of the neck is pressed. The bottles are supported in a frame of wood or metal, and the ends of the bottles bear upon the tails of set screws, which, on being turned round, press the ends of the necks against the washers above referred to, there by effectually stopping the bottles; or the washers may be pressed down on the bottles, which are securely held between the upper and lower rails of the frame. *Patent completed.*

1816. D. Gallafent. *Certain improvements in refrigerators for cooling liquids.* Dated July 19, 1861.

This consists of one or more series of cylinders, each series being formed of three cylinders, in the following manner: Within a cylinder of cast iron or other suitable material, the patentee places a thin copper cylinder, so as to leave a space between the copper and the iron cylinder for the flow or passage of cold liquors. Within the copper cylinder he places a solid cylinder of wood, or hollow cylinder of metal, and of less diameter than the copper cylinder, so as to leave a space between the copper and wood cylinders for the flow of hot wort. The cylinders aforesaid may be made somewhat larger in diameter at one end than at the other, so that the annular space formed by the copper and wood cylinders may be increased or diminished as circumstances may require. To the wood cylinder which is mounted on an axis, or spindle, he communicates (by strap, band, or other suitable means) a rotary motion, the object being to cause the particles of hot wort to be brought in contact with the interior surface of the copper cylinder, which is effected by the friction of the wood cylinder against such particles of hot wort which roll over and over as they pass through the annular space formed by the two cylinders. The hot wort then passes to another series of cylinders or apparatus, same as those hereinbefore described, and so on until the required temperature is obtained. The object of using a solid cylinder of wood or other material inside the copper cylinder is to reduce the capacity of the copper cylinder so as to correspond with the capacity or space formed by the copper and iron cylinders for the flow of cold water. *Patent completed.*

1817. R. Mushet. *Improvements in the manufacture of cast steel.* Dated July 19, 1861.

This invention consists in improving the quality of cast steel by adding to and melting with pulverized pig iron cast iron or refined iron, with pulverized iron or oxide of iron and oxide of manganese, with or without the addition of scrap iron or scrap steel, a quantity of pulverised wolfram ore, or a quantity of tungstic acid, or a quantity of deoxidised wolfram ore, or a quantity of an alloy of tungsten and iron containing also carbon. Also in mixing with the before mentioned steel producing materials a quantity of pulverized chrome ore, or oxide of chromium. Also in adding thereto a quantity of pulverized ores of wolfram and chrome mixed together. Also in adding to and melting with any mixture of materials which when melted produces cast steel, a quantity of a mixture of pulverized pig iron, cast iron, or refined iron, and oxide of manganese with, firstly, pulverized wolfram ore or tungstic acid; secondly, pulverized chrome ore or oxide of chromium; thirdly, pulverized ores of wolfram and chrome mixed, or tungstic acid and oxide of chromium mixed. *Patent completed.*

1818. P. Shaw. *Improvements in hot air engines.* Dated July 19, 1861.

The details of this invention are very voluminous, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed*

1819. R. Laing and G. H. Cossins. *An improved mode of obtaining nitrous acid gas, for making sulphuric acid.* Dated July 19, 1861.

Here the patentees use arsenious or arsenic acid, to decompose nitrate of soda, or nitrate of potash. If nitrate of soda be decomposed, they prefer to use the proportions of seven parts nitrate of soda to five parts of arsenious acid, or six parts of arsenic acid. In performing the above decompositions, they prefer to use a muffle or retort, so placed as to be heated by the furnaces or kilns in which the pyrites are burnt, and to allow the gas to issue from the retort, through a small tube bent in the direction of the

Digitized by Google

draught. The object in using a close vessel and a tube, it to prevent any sulphurous acid gas from coming in contact with the mixture, as in that case sulphate of soda would be formed, which would vitiate the result; and, they use chrome iron ore to decompose nitrate of soda or nitrate of potash. In performing this decomposition the proportions must be regulated by the percentage of chromium contained in the ore employed. For the purpose of effecting this decomposition, they prefer to use a small reverberatory furnace, separate from the pyrite kilns. *Patent completed.*

1820. R. C. NEWBERY. *Improvements in the manufacture of enamelled cards.* Dated July 19, 1861.

This consists in manufacturing cards from suitably prepared paper cloth. The paper cloth is made by causing surfaces, or sheets of pulp or paper to adhere on one or both sides of calico or other woven fabric, producing such a thickness as the particular cards to be manufactured therefrom may require, and using one or more layers of pulp as may be required. The fabrics are then coated and enamelled in the usual way. *Patent completed.*

1821. W. SAVORY, and P. H. SAVORY. *An improved winding apparatus particularly adapted for steam ploughing, winding at pits, quarries, and other such like purposes.* Dated July 19, 1861.

This consists in applying certain mechanism to the barrel or cylindrical part of the horizontal boiler of a stationary or portable engine, for winding ropes or chains at pits' mouths, or for ploughing, &c. The patentee proposes to place a drum or drums round the horizontal boiler, which drum or drums is or are caused to revolve by wheels or gearing connected to the engine. *Patent completed.*

1822. M. HENRY. *Improvements in the production of paper pulp and certain fabrics, also an apparatus for cutting wood, applicable for carrying out part of the invention.* (A communication) Dated July 19, 1861.

The principal object here is making paper pulp, the pulp being obtained from wood, divided, cut, torn, crushed, &c. The processes are also applicable to the treatment of pulp from barks and portions of trees, shrubs, and plants. The invention relates also to bleaching. *Patent completed.*

1823. R. A. BROOMAN. *An improvement in propelling ships and other vessels.* (A communication.) Dated July 19, 1861.

This invention consists in propelling ships and other vessels by the discharge of dry or superheated steam directly against the water. The dry or superheated steam is conveyed through pipes provided with cocks and with adjustable nozzles, so that by turning the nozzles and by allowing the steam to issue from the pipes at any particular part of the vessel at or below the water line, the vessel may be propelled in any required direction. *Patent completed.*

1824. R. A. BROOMAN. *Improvements in breech-loading ordnance, applicable to small arms.* (A communication.) Dated July 19, 1861.

This invention consists in the employment of a breech-block or breech-closer, constructed with a chamber in front of larger diameter than the bore of the piece, and moved up and down to open and close the bore by toggles, connected by a shaft worked by a detachable lever handle. Also in the employment in the chamber, in the face of the block, of an expanding ring, which upon the firing of the charge becomes expanded and renders the breech gas-tight. *Patent completed.*

1825. J. H. JOHNSON. *Improvements in the manufacture of ship's armour plates and other heavy forgings, and in the machinery employed therein.* (A communication.) Dated July 19, 1861.

Here it is proposed to employ a crane and peculiar gripping holders for seizing the pile or faggot in the furnace and conveying the same to the rolls. For reversing or turning-over the pile or faggot, it is proposed to employ a species of horizontal hinged tipping frame upon which the pile or faggot is laid, and which is then elevated at one end by a chain, and suitable windlass, until the frame assumes a vertical position, when by slightly continuing the motion of the free end of the frame, the pile or faggot is turned over into a suitable bed or plate support. There are other features included. *Patent completed.*

1826. W. E. NEWTON. *Improvements in apparatus for copying letters, or writings, and draughts.* (A communication.) Dated July 19, 1861.

Here the leaves of the copying paper are bound or stitched in a flexible wrapper or cover, in the form of a book and in such quantities as will admit of their being rolled up with facility. The back edge of the book with its flexible cover is inserted in a groove made in a metal roller or cylinder, round which the book of copying paper can be wound or rolled. A couple of plain sheets of paper, which if desired may be waterproof, and a sheet of calico, rather larger than the size of the book, form with the metal roller and copying paper all the apparatus which constitutes the present invention. *Patent completed.*

1827. E. T. HUGHES. *Improvements in machinery or apparatus for manufacturing woven seamless gloves.* (A communication.) Dated July 20, 1861.

Here the patentee weaves gloves in an ordinary loom with the assistance of the Jacquard machine, the shape of the glove being made by pattern cards, and the material woven double, forming a kind of pocket. A number of gloves are woven at the same time, according to their size, and the width of the loom. When the piece is finished, each glove is cut out or separated, and after being turned inside out the glove is obtained in a perfect state. *Patent completed.*

1828. M. GILBERT. *Certain improvements in boots and shoes or other coverings for the feet.* Dated July 20, 1861.

This consists in the application and use of the halves of hollow spheres or balls of india-rubber to the soles and heels of boots and shoes, which are permanently secured therein for the purpose of forming cushions or elastic treading surfaces for the feet. Beneath the portion of sole covered by the half spheres an aperture is made in the sole, by which air is kept in circulation by the compression of the india-rubber balls; or a small flat tube may be arranged within the sole, terminating in an aperture beneath the foot, and in communication with the atmosphere by an opening in or near the heel, so as to supply air to the foot. *Patent abandoned.*

1829. W. PRICE. *Improvements in tools for cutting shives and other conical blocks.* Dated July 20, 1861.

This invention consists in fixing upon and around a conical mandril or block a conical band of steel, which is formed with saw teeth for cutting wooden shives and other substances usually cut by saws, and with a knife-edge for cutting cork and other substances requiring a knife-edge for cutting them. The band does not extend around the whole circumferance of the mandril, as there is a space left between the ends thereof, and the entering end is formed with a knife-edge. The cutter is adjustable on the mandril, and is made to protrude more or less beyond the top or the base thereof, according to the thickness of the shive or other article to be cut, and is retained in its position by a ring driven over it and the mandril. The cutting is effected by rotary motion being imparted to the tool. *Patent completed.*

1830. R. THATCHER. *Improvements in lubricators for lubricating the various parts of machinery.* Dated July 20, 1861.

This consists, 1, in lubricating revolving shafts, or other revolving or sliding parts of machinery of every description where it is required, by a sponge which will absorb the oil or other lubricant, and give it to the article requiring lubrication, or by a piece of flannel. 2. In lubricating the top or sides of steam cylinders by the application of a specially constructed tallow cap. *Patent completed.*

1831. T. ROBERTS and J. DALE. *Improvements in the manufacture of gunpowder.* Dated July 20, 1861.

This consists in a method of making gunpowder, whereby the inventors are enabled to use nitrate of soda in place of, or in combination with nitrate of potash, and the principle here proceeded upon is to add thereto a substance which will effloresce, so as to correct the tendency of the other material or materials to become moist. Of these substances the inventors mention, for example, the anhydrous sulphates of soda and magnesia. *Patent abandoned.*

1832. J. PLATT and J. BUCKLEY. *Improvements in machinery for spinning and doubling cotton and other fibrous materials.* Dated July 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1833. J. COLE and J. COLE. *An improvement in the construction of watches.* Dated July 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1834. M HENRY. *Improvements in lighting.* (A communication.) Dated July 20, 1861.

Here, one, two, or more lens discs or lenticular bodies or appliances are employed, which act as projectors, and are placed very near to the luminous agent or light whose effect they are intended to augment. *Patent completed.*

1835. M. A. F. MENNONS. *Improvements in safety locks* A communication.) Dated July 22, 1861.

This consists, 1, in the application to locks of different descriptions of a spiral spring fixed to the external plate by a metallic scutcheon, and giving movement to a spindle in which fits the barrel of the key. 2. In the application to such locks of an independent ward, similar to those of the key, set at the lower extremity of the spindles, which is either squared off or provided with one or several stops, corresponding with an equal number of slots formed at the open end of the barrel of the key. *Patent abandoned.*

1836. C. N. KOTTULA. *Certain new compositions to be used in the manufacture of soap.* Dated July 22, 1861.

This invention consists in forming new compositions, by mixing alum with caustic soda, or with soda ash. When the caustic soda composition is dissolved in water, and the soda ash composition in water to which lime has been added in the usual manner in making ley, purified leys are produced superior to any hitherto obtained for the manufacture of soap. *Patent completed.*

1837. A. WATSON. *Improvements in brake apparatus for common road vehicles.* Dated July 22, 1861.

In this invention advantage is taken of the resistance which the horse exerts against the downward pressure of the vehicle to cause brakes to be applied to the wheels, and so increase the resistance to their turning. In one modification of apparatus for this purpose chains are passed from the ordinary breeching, or from an equivalent strapping passing round the hind quarters of the horse, forward to pulleys or levers carried by the shafts. From these pulleys or levers chains pass back to levers carrying brake blocks, or an equivalent connection is made with the brake levers in such a way that, when the horse holds back, the chains will be strained, and will act on the brake levers, causing the brakes to be pressed against the wheels. *Patent abandoned.*

1838. J. B. WOOD. *Improvements in the manufacture of shuttle-pickers.* Dated July 22, 1861.

This consists in making from buffalo or other hides, parts of hides or other fibrous materials, the picker on one solid piece or block, thus doing away with the necessity and inconvenience of folding the hide upon itself, and the use of iron or other wires to hold the parts in connection. *Patent completed.*

1839. W. HOOD. *Improvements in beams and girders, and in applying the same in buildings.* Dated July 22, 1861.

The hollow iron beam or girders are constructed so that they may be rendered suitable for conveying water into and distributing it in the buildings where such beams or girders are used. Girders so constructed and used will also, by reason of their having water supplied to them, be prevented getting red-hot in case of fire, which would render them unequal to resist the weights thereon. *Patent completed.*

1840. W. E. NEWTON. *Improvements in engines for obtaining motive power.* (A communication.) Dated July 22, 1861.

This consists, 1, in the use of combustible or inflammable gases produced in the gas generator, and in the introduction of these gases, when well purified and mixed with a suitable portion of atmospheric air, into the interior of the engines where they are to be consumed. 2. In first compressing the gases and introducing them under pressure, so as to require very small engines in proportion to the power produced. *Patent completed.*

1841. J. BEATTIE. *Improvements in arrangements in buildings and ships, with the view to the extinguishment of accidental fire therein, and also the ventilation thereof.* Dated July 22, 1861.

This consists in certain main-pipes from which perforated branch-pipes are carried to suitable positions in the building, and through which, in the event of fire, water can be forced by steam or other power. *Patent completed.*

1842. C. BATTY. *The preventing of the extension of fire in buildings.* Dated July 23, 1861.

This consists in so arranging the ceilings that they may be separated from the floor immediately above, by a space through which a current of air passes with a great velocity when the ceiling becomes hot by a fire beneath, thus by keeping the inside or top surface of the ceiling cool, or comparatively so, preventing the floor above becoming heated. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Sept. 19, 1861.

2341. W. T. Tongue, Liverpool, wholesale ironmonger, and J. Greer, tinplate worker. An improved portable self-acting water-engine for extinguishing fires, and other purposes.

2342. J. H. Wilson, Liverpool, brass founder and ship's ironmonger. Improvements in pumps, chiefly applicable to ships' lift pumps.

Dated Sept. 27, 1861.

2415. G. Smith, Liverpool, brass and Britannia metal finisher. Improvements applicable to gas-meters.

Dated Oct. 9, 1861.

2520. G. Davies, 1 Serle-street, Lincoln's-inn, C.E. Improvements in machinery for manufacturing shoes for horses and other animals. (A communication.)

Dated Oct. 21, 1861.

2626. J. S. Phillips, Major H.M.I. R. List, 10 College-crescent, Finchley-road. A new method and apparatus for the propulsion of vessels through the water.

Dated Oct. 25, 1861.

2677. T. Richardson, Newcastle-on-Tyne, and R. Irvine, Hurlet, Renfrewshire, analytical chemist. Improvements in treating bones and gelatine.

Dated Nov. 4, 1861.

2769. W. Clark, 53 Chancery-lane, engineer. Improvements in water meters. (A communication.)

Dated Nov. 13, 1861.

2855. W. H. Balmain, St. Helen's, and J. Kean, manufacturing chemists. Improvements in the manufacture of flowers of sulphur and roll and other forms of sulphur.

Dated Nov. 26, 1861.

2974. D. Ker, West of England Soap Works, Plymouth. An improvement in the manufacture of soap.

Dated Dec. 16, 1861.

3156. J. Aitken, Lasswade, near Edinburgh. Improvements in supplying water to water wheels.

3158. C. Baumann, Altdorf, Weingarten, Wurtumberg. Improvements in buttons.

Dated Dec. 19, 1861.

3185. A. Treuille, and F. X. Traxler, C.E., 29 Boulevart St. Martin, Paris. Improvements in the manufacture of paper and card paper or cardboard, with the object of preventing forgery and alterations in cheques and other documents, and which improvements are also applicable to the manufacture of playing cards and railway and other tickets. (A Communication.)

Dated Dec. 20, 1861.

3196. W. Clark, 53 Chancery-lane, engineer. Improvements in apparatus for the manufacture of matches. (A communication.)

3199. E. E. Pereau, Moorgate-street, merchant. An improved composition for cleaning and revivifying woollen cloths and other fabrics, and the colours thereof. (A communication.)

Dated Dec. 21, 1861.

3210. W. C. Miles, Railway-place, Shoreditch, lamp manufacturer. Improvements in lamp glasses for lamps burning paraffine and other light mineral oils.

Dated Dec. 24, 1861.

3216. C. Smith, Bedford, merchant. Improvements in stays.

3218. C. Smith, Bedford, merchant. Improvements in stays.

Dated Dec. 26, 1861.

3228. T. Simmons, Birmingham, and T. Timmins, general caster, Birmingham. Certain improvements in urns or vessels for holding and supplying hot water, tea, coffee, or other liquids separately or conjointly, as also in the stands for the same.

Dated Dec. 27, 1861.

3240. W. Turner and J. W. Gibson, Hammersmith. Dublin, engineers. Improvements in rolling bridges.

Dated Dec. 30, 1861.

3238. J. B Payne, Chard, engineer and lace manufacturer. Improved machinery for the manufacture of laid and other twine, lines, ropes, bands, and other cordage, whether made of hemp, flax, or other fibrous substances, or of wire.

Dated Jan. 1, 1862.

8. R. A. Brooman, 166 Fleet-street. Improvements in shears or scissors, chiefly applicable to be employed in the manufacture of lace. (A communication.)

11. B. Rhodes, Old Ford, Bow. Improvements in forming or making straight and bent pipes and bends for pipes, and also vessels of various shapes, and in coating and protecting articles and objects of various forms, and in the apparatus to be employed therein.

12. E. Banfield, Ilfracombe, Devon. Improvements in lubricating and maintaining in working order axle journals and brasses, applicable also to other journals and bearings.

15. J. Howard, agricultural engineer, and E. T. Bousfield, engineer, Bedford. Improved apparatus applicable to steam cultivation.

Dated Jan. 2, 1862.

19. A. M. P. Alrian, Rue St. Dominique, St. Germain, No. 8, Paris. A new musical instrument.

22. G. Jeffries, Golden Ball-street, Norwich, gun maker. Improvements in breech-loading fire-arms.

Dated Jan. 3, 1862.

25. G. Stracey, Rackheath Hall, near Norwich. Improvements in the manufacture of artificial fuel.

27. W. E. Gedge, 11 Wellington-street, Strand. Improvements in apparatus for dressing, cleaning, and sifting grain. (A communication.)

Dated Jan. 7, 1862.

44. F. Shaw, bookkeeper, Sheffield. Improvements in apparatus for stopping railway trains.

Dated Jan. 9, 1862.

61. J. Brunt, 15 Rue Petrelle, Paris, engineer. Improvements in gas meters.

63. D. Wilson, Colombo, Ceylon. Improvements in machinery for pulping and preparing coffee.

65. D. Wilson, Colombo, Ceylon. Improvements in hydraulic presses.

67. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in apparatus for carburetting and burning gas. (A communication.)

69. H. Barber, Belgrave, Leicester, manufacturer. Improvements in safety lamps.

Dated Jan. 10, 1862.

70. A. R. Le Mire de Normandy, Odin Lodge, King's-road, Clapham-park, analytical chemist. An improved method of fixing tubes in tube plates.

71. J. Carter, Tipton, Stafford, machinist. A new or improved draining plough.

73 M. Wigzell, Strand, Topsham, Devon. An improved double acting ventilator for railway carriages and other carriages and compartments.

75. J. Oates, Mirfield, York, cabinetmaker. Improvements in washing machines.

76. H. Darvill, New Windsor, gentleman. An improved method of hardening chalk for building purposes.

77. W. H. Preece, Southampton, C.E. Improved apparatus for signalling upon railways.

79. J. Kenyon, Ivy-cottage, Lower Heath, Hampstead, and A. Horn, Great James-street, Bedford-row, engineers. Improvements in railway signalling by electricity, and in the arrangement of apparatus for that purpose.

Dated Jan. 11, 1862.

83. J. White, 7 Trinity-street, Southwark. Improvements in lubricating, or oil cans, or oil feeders, and in the mechanical arrangements for regulating the flow of oil therefrom.

84. L. Mackirdy, Greenock, sugar refiner. Improvements in apparatuses for reburning animal charcoal.

85. T. Scott, Nelson-square, engineer. Improvements in steam engines.

Dated Jan. 13, 1862.

88. J. M. Rowan, Glasgow, engineer. Improvements in the manufacture of iron and steel.

89. T. and C. Gilbert and T. Haddon, Birmingham, manufacturers. An improvement or improvements in the manufacture of swivels for guns, and in machinery to be employed in the said manufacture.

91. T. Soar, Nottingham, machine builder, J. Belshaw, Radford, Nottingham, lace maker, and M. Soar, Nottingham, lace maker. An improved knocker to be attached to doors, shutters, or other parts of premises to which the same may be applicable, and applicable also for the reception of letters and other documents.

95. H. Shotlander, Paris, merchant. Improvements in albums for containing photographic and other pictures.

97. J. Betteley, Liverpool, iron merchant. Improvements in ship building.

98. T. W. G. Treeby, 1 Westbourne-terrace-villas, Paddington, gentleman. An improved method of and apparatus for producing rifled cannon and fire-arms.

99. J. G. Marshall, Leeds, flax spinner. Improvements in the preparation of flax, hemp, and other fibres previous to being spun.

Dated Jan. 14, 1862.

101. J. Carter, 20 Danvers-street, Paulson-square, Chelsea, saddler and harness maker. An improved shaft tug or bearer used in harness.

104. J. Jack, Liverpool, engineer. An improved method of preparing cores for moulding or shaping metals.

105. M. Chadwick, Radcliffe, machine maker. Improvements in machinery for folding or platting cloth and for measuring the same.

109. C. Hill, Ferryside, Kidwelly, Carmarthen, coal agent. Improvements in the manufacture of lubricating compounds.

111. J. O. Marshall, Leeds, flax spinner. Improvements in the machinery and processes for producing fibre from woven and other textile fabrics.

Dated Jan. 16, 1862.

120. T Matanle, 5 Wilmot-square, Bethnal-green-road, brass manufacturer. An improved runner fastening for umbrellas, parasols, sunshades, and other similar articles.

Dated Jan. 18, 1862.

130. J. Taw, Poland-street, Oxford-street, ironmonger. Improvements in the construction of stoves or fire-places.

132. T. Newton, Manchester, gun and rifle manufacturer. Improvements in sights for rifles.

138. W. L. Winans, Baltimore, Maryland, U.S., C.E. Improvements in the manner of mounting and manœuvring cannon or ordnance on ships or vessels of war and floating batteries.

Dated Jan. 20, 1862.

140. W. S. Mappin, Birmingham, manufacturer A new or improved lock.

142. T. Holt, Edward-street, Blackfriars-road, bedstead manufacturer. Improvements in folding iron chairs and chair bedsteads.

144. W. Boaler, Manchester, merchant. Certain improvements in the method of sizing paper yarns and woven fabrics, and in machinery or apparatus connected therewith. (A communication.)

146. J. Bird, Blidworth, Nottingham, farmer and miller. An improved crank axle, applicable to cranks of any description whatsoever wherein the wear is mainly on one side thereof.

Dated Jan. 21, 1862.

154. J. Bate, 18, Crescent, Birmingham. Improvements in machines for corking or stopping the mouths of bottles, jars, or any vessels requiring to be stopped up air-tight.

156. G. T. Bousfield, Loughborough-park, Brixton. Improvements in machinery for making nails and spikes. (A communication.)

160. W. Burgess, Newgate-street, agricultural implement maker. Improvements in reaping and mowing machines.

Dated Jan. 22, 1862.

164. I. Roberts, Liverpool, contractor. Improvements in combined hydraulic motive power engines and meters.

168. T. and J. Little, Alston, Cumberland, grocer and whitesmith. Improvements in apparatus for cooling coffee berries.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

196. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the prevention or removal of incrustation in, or from, steam generators, and in the apparatus employed therein. (A communication.) Dated Jan. 25, 1862.

218. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in engines actuated by heated air, or by combinations of air and steam. (A communication.) Dated Jan. 28, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2264. W. Steevens. Ploughing.
2341. W. T. Tongue and J. Greer. Self-acting water engine.
2342. J. H. Wilson. Ships' lift pumps.
2373. H. Brinsmead. Raising and stacking agricultural produce.
2383. C. Watt, J. Watt, and T. S. Haviside. Bleaching palm oil.
2391. H. Purnell. Warming apparatus.
2396. T. Richardson. Manufacture of muriate of iron.
2400. T. Bentley. Mixing compounds.
2401. H. Nunn. Mangles.
2405. S. S. Robson. Raising or lowering heavy bodies.
2407. J. Tessier. Treating corn.
2410. V. S. Lete. Wines.
2415. G. Smith. Gas meters.
2424. S. W. Rix. Fixing woodwork. (A communication.)
2425. J. Reeves. Electro-magnetic engines.
2428. T. Potts. Clasps.
2429. M. Theiler. Telegraphs.
2434. B. G. George. Mounting.
2435. J. Lush. Mashing attemperators.
2442. W. E. Matthews. Communication from a ship or vessel.
2448. W. H. Payn. Preventing the loss of and facilitating the recovery of ships' moorings. (A communication.)
2458. R. A. Brooman. Manufacture of fabrics. (A communication.)
2459. W. Thompson and T. Stather. Hydraulic presses.
2472. J. Wood. Pens.
2485. S. Icely. Gongs.
2496. T. Hughes. High pressure tap.
2508. W. Willis. Organs.
2520. G. Davies. Horse shoes. (A communication.)
2538. W. Clark. Bending rails or bars. (A communication.)
2578. W. Clark. Securing mail bags and other packages. (A communication.)
2589. T. E. Merritt. Motive power.
2649. J. P. V. Delfry. Kneading trough.
2740. E. A. Maling. Glass cases.
2761. G. Evans. Treating peat.
2795. J. R. Wigham. Manufacture of gas.
2974. D. Ker. Manufacture of soap.
3035. W. E. Gedge. Nose bags. (A communication.)
3101. M. A. F. Mennons. Jack machinery. (A communication.)
3112. M. A. F. Mennons. Purifying cane. (A communication.)
3177. J. M. H. A. Taurines. Constructing weighing machines.
3202. G. Tomlinson. Boots and shoes. (A communication.)
15. J. Howard and E. T. Bousfield. Steam cultivation.
62. T. A. Weston. Gearing.
88. J. M. Rowan. Manufacture of iron and steel.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Jan. 31, 1862.

1928. C. Schinz.
1934. A. Prince.
1943. R. A. Brooman.
1944. F. Seiler.
1950. R. Wappenstein.
1952. F. Tolhausen.
1953. J. M. Murran.
1957. A. V. Newton.
1996. T. G. Webb.
2026. W. Wilds.
2053. W. Bennett.
2063. G. Ingram.
2088. M. A. F. Mennons.
109. W. D. Player.
2222. M. A. F. Mennons.
2230. J. J. Russell.
2268. M. A. F. Mennons.
2295. H. C. Jennings.
2524. J. J. Russell.
2575. J. J. Adams.
2686. J. L. Sicard.
2810. A. B. Berard.
2863. G. T. Bousfield.

Sealed Feb. 4, 1862.

1939. P. Silvester.
1981. A. J. Mott.
1982. C. P. Moody.
1986. H. Chatwin.
1989. J. Gray, T Kershaw, B. Crowther, and A. Dean.
1990. R. A. Godwin.
1997. A Barclay.
1998. M. Wigzell.
1999. M. Wigzell.
2013. B. Cooper.
2017. E. A. Rippingille.
2029. S. Carey and W. M. Pierce.
2005. W. Pitkin.
2074. R. S. Lambert.
2078. N. Fisher.
2083. W. Clark.
2094. J. Kane.
2102. W. Baines.
2104. J. Whitworth and W. W. Hulse.
2117. J. Cranston.
2143. W. S. Guinness.
2679. J. B. Schalkenbach.
2738. W. J. Williams.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

276. J. Robertson.
280. J. Grimond.
295. W. E. Newton.
301. S. Tearne.
301. J. Hirst and J. Hollingworth.
309. W. Clayton and J. Goodfellow.
312. S. D. Davison.
326. P. Adie.
357. A. Clark.
398. S. H. Huntly.
422. J. T. Jones.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

244. T. O. Dixon.
250. G. Ritchie.
320. A. E. L. Bellford.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Feb. 1, 1862.

No.	Pr.		No.	Pr		No.	Pr.		No.	Pr.		No.	Pr		No	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
1539	0	10	1553	0	6	1567	0	11	1581	0	10	1595	0	3	1609	0	5
1540	0	3	1554	0	3	1568	0	3	1582	0	3	1596	0	5	1610	1	3
1541	0	7	1555	0	6	1569	0	3	1583	0	3	1597	0	5	1611	1	5
1542	0	10	1556	0	9	1570	0	7	1584	2	4	1598	0	3	1612	0	3
1543	0	3	1557	0	4	1571	1	1	1585	0	3	1599	1	10	1613	0	7
1544	0	3	1558	0	3	1572	0	3	1586	0	5	1600	0	7	1614	0	3
1545	0	10	1559	0	8	1573	0	3	1587	0	7	1601	0	8	1615	0	10
1546	0	9	1560	0	7	1574	0	6	1588	0	3	1602	0	6	1616	0	7
1547	0	4	1561	0	3	1575	0	3	1589	0	10	1603	0	[illegible]	1617	1	1
1548	0	4	1562	0	7	1576	0	3	1590	0	10	1604	0	10	1618	0	3
1549	0	5	1563	0	10	1577	0	7	1591	1	8	1605	0	3	1619	0	4
1550	0	3	1564	0	3	1578	0	3	1592	0	3	1606	0	5	1620	0	3
1551	0	10	1565	0	7	1579	1	5	1593	0	3	1607	0	3	1621	0	6
1552	1	0	1566	0	3	1580	0	3	1594	0	3	1608	0	7	...	...	

PRICES CURRENT OF METALS.

London, Feb. 6, 1862.

		£ s. d		£ s. d	per ct.
IRON:					
Rails in Wales and North of England	pr. ton	5 5 0	to	0 0 0	nett
Welsh Bars, in Wales	,,	5 5 0	,,	5 7 0	3
Staf. Bars, at the Works	,,	5 10 0	,,	7 5 0	2½
,, Hoops	,,	7 10 0	,,	0 0 0	,,
,, Sheets, Singles	,,	0 0 0	,,	0 0 0	,,
,, Nail Rods	,,	5 15 0	,,	8 10 0	,,
,, Boiler Plates	,,	8 0 0	,,	8 10 0	,,
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 7 0	,,	0 0 0	nett
Do. No. 1, Good Brands	,,	2 11 0	,,	2 15 0	,,
Scotch Bars	,,	7 5 0	,,	7 15 0	,,
Swedish Bars, in London	,,	10 10 0	,,	11 0 0	,,
COPPER:					
Sheet and Sheathing	per lb.	0 0 11	,,	0 0 0	3
Tough Cake and Tile	pr. ton	98 0 0	,,	0 0 0	,,
Best Selected	,,	101 0 0	,,	0 0 0	,,
Australian	,,	100 0 0	,,	0 0 0	,,
South American	,,	0 0 0	,,	0 0 0	,,
Yellow Metal Sheathing	per lb.	0 0 9½	,,	0 0 0	2½
STEEL:					
Swedish Keg	pr. ton	16 0 0	,,	0 0 0	2½
,, Faggot	,,	16 0 0	,,	0 0 0	,,
TIN:					
English, Block	p. cwt.	6 1 0	,,	0 0 0	2½
,, Bar	,,	6 2 0	,,	0 0 0	,,
Foreign, Banca	,,	6 4 0	,,	0 0 0	net
,, Straits	,,	5 19 0	,,	0 0 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 7 0	,,	1 0 0	3
Coke, I.C.	,,	1 1 6	,,	1 4 0	,,
LEAD:					
Pig, English	pr. ton	19 10 0	,,	20 0 0	2½
,, Spanish	,,	16 0 0	,,	19 10 0	,,
Common Sheet	,,	21 10 0		22 0 0	,,
Tea ,, [Wimshurst's Patent] A special disct.	,,	23 0 0	,,	0 0 0	,,
SPELTER:					
On the spot	,,	18 0 0	,,	0 0 0	nett
For arrival	,,	19 5 0	,,	16 7 6	,,
ZINC:					
English Sheet	,,	24 0 0	,,	0 0 0	1
QUICKSILVER	pr. btl.	7 0 0	,,	0 0 0	3

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers E.C.

THE
MECHANICS' MAGAZINE.
LONDON, FRIDAY, FEBRUARY 14, 1862.

ON FUEL.

Article IV.—Coal.

The celebrated trial respecting the Torbanehill mineral, has proved that there is no strict and rigorous definition as to what constitutes coal. The trial, as most of our readers may remember, was to determine whether a certain valuable combustible mineral was to be regarded as a bituminous schist, or as a true coal. In the former case, it would have belonged to the freeholder; in the latter, it would be the property of the lessees, who had the right of working the coal contained in the estate.

The scientific evidence given on both sides was very voluminous, and perfectly contradictory; consequently, it was altogether negatived by the Lord Justice-General, who, in his recapitulation, asked, "Was it coal in the language "of those persons who deal and treat with that "matter, and in the ordinary language of "Scotland? Because, to find a scientific definition of coal after what has been brought "to light within the last five days, is out of "the question. But was it coal in the common use of that word, as it must be understood to be used in language that does not "profess to be the purest science, but in the "ordinary acceptation of business transactions "reduced to writing? Was it coal in that "sense? That is the question for you to "solve." The verdict of the jury was in favour of this mineral being regarded as coal; since then the general impression has prevailed that the mineral is not a true coal, but that it is what the freeholders endeavoured to prove it to be, namely, a bituminous schist.

After the contradictory, and not very creditable display of scientific differences that took place on this occasion, it is evident that the definition of coal is not an easy task. Scientific men are, however, so far agreed as to regard all coal as consisting of altered vegetable matter, but the alteration may be so slight that the coal retains the fibrous, in some instances even the flexible character of the vegetable tissues from which it was derived, this being the case in several of the lignites; or it may be carried to such an extent that 95 per cent. of the mass consists of carbon, as in some of the anthracites.

Dr. Percy gives the following as the nearest approach to a definition, and it should be borne in mind that his work was published after the trial respecting the Torbanehill mineral. He states:—"Coal is a solid mineral substance, "more or less easily combustible, varying in "colour from dark brown to black, opaque—"except in extremely thin slices—brittle, not "fusible without decomposition, not sensibly "soluble in ether, benzole, chloroform, or turpentine—not containing sufficient earthy "matter to render it incapable of being applied "with advantage as a source of heat in ordinary "fire-places and furnaces." This, which may be regarded rather as a description than a definition, is, nevertheless, perhaps the best and closest of which the subject admits, for, as the author further remarks, it would exclude amber and other resinous matters, bitumen and bituminous schists, when they contain so large an amount of earthy matter as to be incapable of being employed as fuel, and would also exclude even the most compact varieties of peat, none of which can be properly considered brittle.

The gradual transition from one variety of coal to another, the insensible gradation from the woody lignites of Bovey to the nearly pure carbon which constitutes the Welsh coal and anthracite, is well illustrated in the following table, which we quote from the same author:—

	Carbon.		Hydrogen.		Oxygen.
Wood, mean of 26 analyses......	100	...	12·18	...	83·07
Peat..	100	...	9·85	...	55·67
Lignite, mean of 15 varieties ...	100	...	8·37	...	42·42
Ten Yard Coal, South Staffordshire..................................	100	...	6·12	...	21·23
Steam coal (Tyne)	100	...	5·91	...	18·32
Pentrepelin coal, South Wales...	100	...	4·75	...	5·28
Anthracite, Pennsylvania	100	...	2·84	...	1·74

Bearing in mind the fact, that during combustion eight parts of oxygen are required to unite with one of hydrogen to form water, it will be seen that in every case there is an excess of hydrogen over that required to unite with the oxygen present in the fuel.

Coal differs essentially from wood and peat in containing a comparatively large proportion of nitrogen; this varies usually from one to two per cent. The nitrogen in coal is a very important subject of consideration; when coal is submitted to destructive distillation in close vessels, as in the process of gas making, this nitrogen unites with a portion of the hydrogen present, and constitutes ammonia; hence the products of the distillation of coal are always alkaline. Wood, on the contrary, furnishes, under the same circumstances, what is termed pyroligneous acid, which is now recognized as being identical with the acetic acid produced by the ordinary acetous fermentation. Another element always present in coal is sulphur. It is usually found in combination with iron, constituting the bisulphide of iron, better known as iron pyrites. In many varieties of coal this is present in large quantity, in golden yellow masses, frequently of considerable size. Exposed to the air, many varieties of iron pyrites undergo oxidation—in some cases, slowly, in others, with considerable rapidity; in the latter, so much heat is generated, that the coal may take fire spontaneously. When the iron pyrites oxidates more slowly, the tissue of the coal is broken up, or disintegrated. This change frequently occurs in many of the varieties of lignite that abound with pyrites.

Water is always present in coal to a greater or less extent, in some cases even as much as twenty per cent. has been expelled by drying at a temperature of boiling water; in an economic point of view the power of coal to absorb water is one of very considerable importance, and has not received the attention it demands. It is well known that for ordinary domestic purposes coal is greatly deteriorated in value when it has been exposed to wet, and there is no doubt but that its value for manufacturing and metallurgic uses is equally lessened. The absorption of water by dry coal, and the length of time required for its subsequent desiccation by exposure to the air would afford a subject for a most useful series of experiments.

Omitting the sulphur, which has been already alluded to, the mineral matter present in coal, consists of iron generally in combination with sulphur, lime, silica, and alumina; of the total amount of mineral matter, the silica usually constitutes more than one half, being united with the alumina, and either diffused through the entire mass or constituting shale, or what is popularly known as *slate* in the coal.

The ashes of coal are constituted by the mineral matters that remain after the combustion of the organic portion; if these ashes are compared with those of wood, a great deficiency of potash will be noticed, hence the small value of coal ashes as a manure compared with wood ashes.

The red ash, which is produced by many varieties of coal, indicates the presence of iron pyrites, and the depth of colour may be taken as affording an indication of the amount. The presence of a large proportion of pyrites in the coal is not only detrimental to its value as a house fuel, from the amount of sulphurous acid given out during its combustion, but is of serious moment when it is employed as a furnace fuel, the sulphur acting very energetically on the iron of the furnace, and rapidly destroying the fire-bars. In many cases the ashes left after the combustion of the coal are more or less fusible, melting together, and forming what is known as clinkers. This may be injurious in two modes; by accumulating in the bars, it impedes the draught of air, and so lessens the temperature of the furnace, and at other times, however paradoxical it may appear, it raises the temperature of the fire-bars, and so causes their more rapid destruction; this latter effect is produced when the bars are protected from cold air by the adhering clinker.

Injurious as the presence of clinkers are in general; in some cases, says Dr. Percy, "a "bed of clinkers is expressly formed, and "made to serve an important purpose. Thus "in furnaces in South Wales, such a bed is "ingeniously used as a substitute for a grate "on which small and inferior coal may be "consumed which could not otherwise be profitably employed. The bed is allowed to "become twelve to twenty inches thick, and "requires to be supported only by a few bars, "which, being far removed from the fuel, remain comparatively cool.

"It is kept broken up, so that sufficient "quantity of air may traverse it, and in proportion as it accumulates above, it is cut "away underneath by means of a crowbar "with a cutting edge and a heavy hammer. "This operation is termed breaking the grate. "However, as a rule, the less a coal clinkers "the better for most purposes, and for "none more so than for boiler furnaces. A "certain amount of inorganic matter in coal "is sometimes beneficial, preventing the fire "collapsing too rapidly in the furnace." Hence some of the Birmingham smelters prefer for their reverberatory furnaces a variety of coal from the centre of the thick or ten yard seam of South Staffordshire, this is termed *Brasils*, it abounds in earthy matter, yielding between six and seven per cent. of a reddish grey ash, and it also contains rather more than one-half per cent. of sulphur united with iron, to constitute pyrites.

The consideration of the distinctive properties and uses of the different varieties of coal will form the subject of the following article.

OUR ARTILLERY PROSPECTS.

(From the *Dublin University Magazine*.*)

Having minutely studied all the peculiarities of the Armstrong system, we believe that Armstrong guns, whether field-pieces or heavy ordnance, are and must be defective, as the very consequence of natural laws. Our opinion, however, is of minor consequence on this point. The main matter for present consideration is not what Sir William Armstrong fancies he *can* accomplish, but what he *has* already accomplished; and having regard to what he has already done, whether Parliament next session will be warranted in granting him a further subsidy. Such are the main questions for consideration; and despite the strenuous endeavours of Sir William Armstrong's party, we think the public will insist on their being considered. To this end there can be no tribunal so fair and efficient as a Parliamentary Commission. Not a select committee, which would be a tribunal too little independent of extra-parliamentary influences, but a *commission;* not necessarily composed of Members of Parliament, but gentlemen who, from their technical and scientific knowledge, would be qualified to speak with authority on the scientific issues.

---

* It will be seen that this article confirms most of the statements which the Mechanics' Magazine has from time to time made in reference to the Armstrong artillery.

Sir William should be clearly made to understand that the British public will stultify themselves if they rest satisfied with any so-called investigation by the Ordnance Select Committee or the War Office.

Since rumours of the failure of the Armstrong system have found their way into print, we regret to notice a system of ingenuity much to be deprecated—one that cannot prove ultimately advantageous to any person or any interest. The Admiralty in October declined to receive any more of the 100-pounder Armstrong gun *for the present.* This fact was officially announced, and is, therefore, well known. Since then Sir William seems to have been cultivating a crop of experiments, the results of which—ostensibly successful and extensively published—tend to confuse still more the already embarrassed evidence on this all-important subject. For example, about two months ago an announcement headed "breech-loading ordnance" appeared in the *Times*, intimating that a large breech-loading gun of Sir William Armstrong's construction, but having the apparatus for closing the breech arranged to work from the side, was tried for quick and continuous firing by the Ordnance Select Committee, that the time occupied in firing fifty-one rounds was only twenty-one minutes and fifty-six seconds; and that the escape of gas at the breech was effectually prevented. Accepting, for the purposes of argument, these facts as they stand—conceding this breech-loading gun to be eminently successful in all respects—would not the plain inference be, judging from the statement that the gun in question was not only constructed by Sir William Armstrong, but that it was an Armstrong gun—according to definition *the* Armstrong gun, in respect of which so much adverse criticism has appeared, and in behalf of which Parliament voted two millions. Not a bit of it. The gun in question is made on the Prussian model, with the means of breech closure invented by Messrs. Church and Goddard superadded.

Nobody doubts that Sir William Armstrong may in the end make a satisfactory gun if profusely furnished with public money, and if abolition of the patent laws be accomplished; but why this concession and revolution in favour of any individual? and why does the War Office make it a point of honour to recognise the merit of no guns except his? Captain Blakely has again and again offered to manufacture, at his own expense, a piece of ordnance, the shell of which should penetrate a target equivalent in resistance to the Warrior. Why has his offer not been accepted? Mr. Lancaster has long succeeded in perfecting his system, as explained by us in February, so that spiral oval shells may be fired successfully from oval-bored guns. His guns can discharge all the ordinary ammunition of the service in addition to their own. Why then is the Lancaster system kept so assiduously in the background?

Enough has been said, we fancy, to prove that an inquiry, minute and impartial, is urgently required. That there will be an investigation of some sort we do not doubt; and we may be pardoned for giving utterance to the hope that the daily press may not be made the cause of embarrassment or confusion to the tribunal of investigation, wherever it may be installed, and of whatever sort it may be.

Here, whilst on this topic, it is lamentable to contemplate the flood of error which the *Times* newspaper has caused to be circulated in respect of the two artillery constructors, Whitworth and Armstrong. For example, in regard to the first, the *Times* newspaper, quoting from a Manchester paper,[*] caused the announcement to go forth that Mr. Whitworth's experiments, conducted at Southport in July, 1860, were eminently successful. We do not overmuch like to employ the words "success" and "failure," because of their indefiniteness; but only by a long stretch of fancy, indeed, could Mr. Whitworth's experiments at Southport be called successful. After firing near one hundred shots at a target a thousand yards off, the target was not once hit. More than a dozen friction tubes were exploded before the eighty-pounder could be fired; all the friction tubes were launched violently backwards; and the major part of spent cartridges had to be dug out of the eighty-pounder by a handspike. Mr. Whitworth is a good mechanician, and when he turned his attention to artillery and small-arms much was expected of him. He has been liberally supplied with public money, and has in every way had a fair field.

The public have been misinformed in regard to the achievements of this gentleman as a manufacturer of fire-arms; and we have to express our regret that the *Times* has been foremost in promoting the misconception.

It is time the reign of misconception should end. The practical issue is, that whilst the French have good broadside guns for their navy, and whilst Captain Blakely is arming the land and sea forces of Spain with good rifled ordnance, England has not at the time being one single accepted piece of rifled ordnance. The Admiralty have done their duty so far as in them lies. They refuse finally to recognise the Armstrongs presented to them by the War Office and Ordnance Select Committee. But is it not a folly that the Admiralty should be in any way dependent on the War Office and Ordnance Select Committee for the choice of their armament? Would it not be more rational that the Admiralty should have their own technical staff of artillery constructors, engineers, laboratory officers, &c., for themselves? Naval guns involve special conditions, which naval men surely may be expected most clearly to perceive. Thus, a recent letter from Captain Halsted first made known the startling fact, that be the Armstrong ordnance ever so successful as engines of projection, they necessitate such 'tween-deck height, that ships would have to be built on purpose to hold them. And all this sacrifice in behalf of guns that even in the greatest emergency cannot be loaded at the muzzle, cannot fire any ammunition but their own, cannot discharge red-hot shot or shells filled with molten iron, dare not use cartridge a trifle too short for fear of bursting the gun; and at any moment may do, as they have done, blow down rear right-hand men if provided with side apertures; and, if made on the upward aperture construction, blow their vent-pieces, as on board the Excellent, clean through the deck.

Of course these observations are made in the fullest cognizance of Sir William Armstrong's two rejoinders in the *Times*. We have studied these documents carefully, and fail to perceive that they disturb the adverse evidence previously adduced in any particular. Sir William's last rejoinder was a most ingenious document. Sir William cites the practice of a heavy gun made by him; but which, indeed, was wholly different from *the* Armstrong gun by definition. Now whether this new gun—the shunting gun, as it has been called—be good or bad, we do not propose to argue. All we wish to state is, that it wholly and absolutely differs from the Armstrong gun; and that Sir William never attempted to make this variety of ordnance until practice had demonstrated the inefficiency in certain respects of the real Armstrong weapon. This is a fact which would never have been gathered from Sir William's own explanations.

We have already stated that if the Armstrong guns in their smaller forms do not answer, then *a fortiori*, can they not answer in any larger form. This conclusion is naturally deduced from a consideration of the principles involved. It might be theoretically possible that a gun of some given pattern should be reliable enough as a field-piece, but that it should fail on a larger scale. Our contemporary, the *Saturday Review*, imagines this to represent the case of the Armstrong guns. Taking for granted the demonstrated insufficiency of the larger Armstrongs—a thing sufficiently proved by Sir William's endeavours to mix up shunting ordnance with considerations of his own original weapon; proved, moreover, by his own admissions last year before the Society of Civil Engineers—the *Saturday Review* concludes that the thorough efficiency of the Armstrong field-pieces may be considered as demonstrated by the experience of the Chinese campaign. We should like to be able to adopt this view of the case; but it is diametrically opposed to our evidence. It is wholly repugnant to the high testimony of Sir Howard Douglas, and it is, as we shall presently show, inconsistent with the report of the Chinese correspondent of the *Times* newspaper. Again, Major Hay being called upon to give evidence favourable to the Chinese practice, damages the cause his observations were meant to serve. "It would have been most surprising," he states, "if slight alterations had not suggested themselves in both guns and ammunition, considering that they were being tried for the first time, and that they were most jealously watched by all. In fact, from the instructions I received before leaving England, it was my duty to point out the slightest defect. This I did; and I was glad to observe, in a recent visit to the Royal Arsenal, Woolwich, that these defects had all been remedied in a manner which experiments had proved to be most successful."

Again, in another part of Major Hay's letter we find the expression:—"The guns never ceased firing because of any casualty to our men." The tenor of this letter is, we say, most damaging when regarded as the answer—the best that could be given as is fair to assume—to the statements brought forward by us in February last; published in the MECHANICS' MAGAZINE, vouched by Captain Halsted, and lastly, by that very high authority, the late Sir Howard Douglas. It is fair to assume that Major Hay would have testified, had he been able, that breech-pieces did *not* fly out, that Armstrong guns had *not* to be withdrawn, no matter from what cause, that fuses did *not* spontaneously ignite *in transitu;* and that none of our men suffered casualties by the dispersion of lead from Armstrong shells fired over their heads.

He acknowledges the necessity for effecting slight alterations both in guns and ammunition. What were they, and why not allow the public to judge as to their gravity? He pronounces confidently as to the result of experiments at Woolwich; but in what manner can experience gained with recent ammunition rebut the allegation that Armstrong shells and fuses cannot withstand storage and climatic vicissitudes?

Hear what Sir Howard Douglas testified concerning the alleged danger from lead dispersion in a letter addressed to the *Dublin University Magazine:*—

> "I have good information," he wrote, "respecting the real performances of the Armstrong guns, which *entirely corroborates what you state of the lead having blown off, to the great peril of the troops lying down in front*, and over whose heads the shells were projected; and that danger is now so manifest that it will not, I think, be again attempted. This will be a serious disability in war, for batteries have often occasion to fire over advanced works."

In reply to this precise testimony, Sir William Armstrong and his friends have not adduced one positive denial. What then is the inference? Strangely enough, the China correspondent of the *Times* has been popularly thought to have established the character of the Armstrong field-pieces in the Chinese campaign; and this despite the following positive testimony. We quote it verbatim:—

"At 6 A.M., on the 14th," (August, 1860), wrote poor Mr. Boulby, "the whole army was afoot, and soon after that hour the march commenced. The guns were in front, with 200 rifles in skirmishing order under the command of Major Rigaud. Then followed the first brigade, consisting of the Royals and 21st, followed by the second, the Queen's 60th rifles, and 15th Punjabees—the division being under the command of Sir John Michel. The second division halted on the ground occupied by the first on the previous night. Just at the angle where the river bent to the right, a casemated battery had been formed by the Tartars, in a creek on the south bank with a view of taking the allied troops in flank. At a turn of the steam three-quarters of a mile lower down, another battery was visible, whose fire crossed that of the creek guns. The first of these batteries fired the previous day on a reconnoitering party, so it was resolved to silence it before commencing operations against the intrenchments. Two of Baring's Armstrongs were detailed for the purpose, and at twenty minutes past six they opened on the Chinese at 250 yards. The enemy were not slow in replying, and for ten minutes a very pretty duel was carried on. The range seemed too close, so three of Desborough's 24-pounder howitzers were ordered to the front, and in five minutes the Chinese fire was completely silenced."

---

[*] Why was the Manchester paper quoted at all? A delegate from the *Times* witnessed himself the experiments; why did he not record their issue?

Here, then, is the record of one who had pronounced very favourably on the merits of Sir William's field-pieces on a previous occasion. How damaging is his present testimony? Here we confessedly have guns that could not defend themselves at 250 yards, because—and the reason is most amusing—"*the range seemed too close,*" whereupon a howitzer battery had to be brought in front (a euphemism for "the Armstrong battery had to be withdrawn"), and "in five minutes the Chinese fire was completely silenced."

It is impossible, we think, to weigh all this evidence, gathered from independent sources, without coming to the conclusion that the Chinese experience very far from justifies the common belief in the safety and thorough efficiency of the Armstrong field-pieces. That they shoot correctly no one doubts, that they shoot fair is a necessity, being rifled, that the segmental shell is deadly against troops is demonstrated. Conceding all this, however, the Armstrong field-piece and ammunition may both be still defective, and as to the larger guns now being made by Sir William, whother good, bad, or indifferent, they are fundamentally different from the original Armstrong gun—the weapon that has been fancied to have achieved so complete a success.

LLOYD'S REGISTER OF BRITISH AND FOREIGN SHIPPING.

ANCHORS AND CABLES.

THE committee of this society have passed the following resolutions in reference to anchors and cables :—

1. That the table No. 22 be amended by defining a minimum weight for Anchors of approved make, whether ordinary or patent, thus discontinuing any distinction in favour of (so called) Patent Anchors.

2. That in future one weight only for Anchors be recognised, and that the lighter weight, or that hitherto required for Anchors with wood stocks, be adopted in framing the scale.

3. That it be made a rule that two of the Bower Anchors be of at least the weight set forth in the table, and that then the third Anchor may be lighter; the reduction in weight, however, not to exceed 15 per cent.

4. That the Stream Anchors be one-third the weight of the Bowers, the first Kedge Anchor one-half the weight of the Stream Anchors, and the second Kedge one-half the weight of the first Kedge Anchor.

5. That all Anchors be subjected to a proof strain equal to that shewn in the table No. 22.

6. That the recognition of the test for Chain Cables known as the "Ordinary" or "Merchant" proof be discontinued; and that all new ships be required to be supplied with Chains which have been submitted to a proof strain equal to that known as the "Admiralty test," and of the sizes shewn in the Table No. 22. And that after the 1st January, 1863, all chains supplied to ships be subject to the same regulations.

7. That such Chains as will satisfactorily bear a strain of 10 per cent. greater than the Admiralty proof for a Chain of the full size for the vessel's tonnage be allowed of the reduced sizes shewn in the Table No. 22.

8. That Chains already made which will not bear the Admiralty test, may be admitted in lieu of lighter chains, according to the proof to which they have been subjected. For example—a 2-inch Chain which has been proved to the extent required by the Admiralty test for a 1⅞in. chain may be admitted to serve as a 1⅞in. chain.

The above Resolutions, so far as they relate to *the weight of Anchors*, will come into force, as a rule, at the end of six months from the present date, The regulations in regard to the testing of Anchors and Chain Cables will not be enforced until 1st January, 1863.

PHYSICAL CONSIDERATIONS REGARDING THE POSSIBLE AGE OF THE SUN'S HEAT.

BY PROFESSOR W. THOMSON.[*]

THE author prefaced his remarks by drawing attention to some principles previously established. It is a principle of irreversible action in nature, that, "although mechanical energy is indestructible, there is a universal tendency to its dissipation, which produces gradual augmentation and diffusion of heat, cessation of motion, and exhaustion of potential energy, through the material universe." The result of this would be a state of universal rest and death, if the universe were finite and left to obey existing laws. But as no limit is known to the extent of matter, science points rather to an endless progress through an endless space, of action involving the transformation of potential energy through palpable motion into heat, than to a single finite mechanism, running down like a clock and stopping for ever. It is also impossible to conceive either the beginning or the continuance of life without a creating and over-ruling power. The author's object was to lay before the Section an application of these general views to the discovery of probable limits to the periods of time *past* and *future*, during which the sun can be reckoned on as a source of heat and light. The subject was divided under two heads: 1, on the secular cooling of the sun; 2, on the origin and total amount of the sun's heat.

In the first part it is shown, that the sun is probably an incandescent liquid mass radiating away heat without any appreciable compensation by the influx of meteoric matter. The rate at which heat is radiated from the sun has been measured by Herschel and Pouillet independently; and, according to their results, the author estimates that if the mean specific heat of the sun were the same as that of liquid water, his temperature would be lowered 1°·4 Centigrade annually. In considering what the sun's specific heat may actually be, the author first remarks that there are excellent reasons for believing that his substance is very much like the earth's. For the last eight or nine years, Stoke's principles of solar and stellar chemistry have been taught in the public lectures on natural philosophy in the University of Glasgow; and it has been shown as a first result, that there *certainly is sodium in the sun's atmosphere*. The recent application of these principles in the splendid researches of Bunsen and Kirchhoff (who made an independent discovery of Stokes's theory), has demonstrated with equal certainty that there are iron and manganese, and several of our other known metals in the sun. The specific heat of each of these substances is less than the specific heat of water, which indeed exceeds that of every other known terrestrial solid or liquid. It might therefore at first sight seem probable that the mean specific heat of the sun's whole substance is less, and very certain that it cannot be much greater, than that of water. But thermodynamic reasons, explained in the paper, lead to a very different conclusion, and make it probable that, on account of the enormous pressure which the sun's interior bears, his specific heat is more than ten times, although not more than 10,000 times, that of liquid water. Hence it is probable that the sun cools by as much as 14° C. in some time more than 100 years, but less than 100,000 years.

As to the sun's actual temperature at the present time, it is remarked that at his surface it cannot, as we have many reasons for believing, be incomparably higher than temperatures attainable artificially at the earth's surface. Among other reasons, it may be mentioned, that he radiates heat from every square foot of his surface at only about 7,000 horse-power. Coal burning at the rate of a little less than a pound per two seconds would generate the same amount; and it is estimated (Rankine, 'Prime Movers,' p. 285, edit. 1859) that in the furnaces of locomotive engines, coal burns at from 1 lb. in 30 seconds to 1 lb. in 90 seconds per square foot of grate-bars. Hence heat is radiated from the sun at a rate not more than from fifteen to forty-five times as high as that at which heat is generated on the grate-bars of a locomotive furnace, per equal areas.

The interior temperature of the sun is probably far higher than that at the surface, because conduction can play no sensible part in the transference of heat between the inner and outer portions of his mass, and there must be an approximate *convective* equilibrium of heat throughout the whole; that is to say, the temperatures at different distances from the centre must be approximately those which any portion of the substance, if carried from the centre to the surface, would acquire by expansion without loss or gain of heat.

PART II. *On the Origin and Total Amount of the Sun's Heat.*

The sun being, for reasons referred to above, assumed to be an incandescent liquid now losing heat, the question naturally occurs, how did this heat originate? It is certain that it cannot have existed in the sun through an infinity of past time, because as long as it has so existed it must have been suffering dissipation; and the finiteness of the sun precludes the supposition of an infinite primitive store of heat in his body. The sun must therefore either have been created an active source of heat at some time of not immeasurable antiquity by an overruling decree; or the heat which he has already radiated away, and that which he still possesses, must have been acquired by some natural process following permanently established laws. Without pronouncing the former supposition to be essentially incredible, the author assumes that it may be safely said to be in the highest degree improbable, if, as he believes to be the case, we can show the latter to be not contradictory to known physical laws.

The author then reviews the meteoric theory of solar heat, and shows that in the form in which it was advocated by Helmholz[*] it is adequate, and it is the only theory consistent with natural laws which is adequate to account for the present condition of the sun, and for radiation continued at a very slowly decreasing rate during many millions of years past and future. *But neither this nor any other natural theory can account for solar radiation continuing at anything like the present rate for many hundred millions of years.* The paper concludes as follows :—"It seems, therefore, on the whole, most probable that the sun has not illuminated the earth for 100,000,000 years, and almost certain that he has not done so for 500,000,000 years. As for the future, we may say with equal certainty that inhabitants of the earth cannot continue to enjoy the light and heat essential to their life for many million years longer, unless new sources, now unknown to us, are prepared in the great storehouse of Creation."

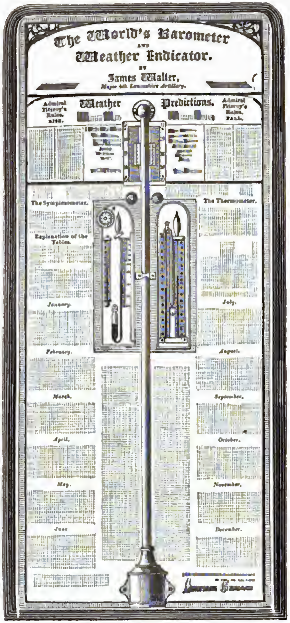
---

[*] Read at the Meeting of the British Association at Manchester, September 1861.

[*] Popular Lecture delivered at Königsberg on the occasion of the Kent commemoration, February, 1854.

MAJOR WALTER'S "WORLD'S BAROMETER."

MAJOR WALTER, who for some years has devoted attention to meteorology, shows the practical bent of his genius by producing a barometer which appears to be as much superior to the ordinary instrument now in use as the modern chronometer is to the antique water-clock. Under the title of "The World's Barometer and Weather Indicator," we here have, says the *Liverpool Mercury*, a barometer especially adapted to the new weather science, and which renders its study as simple as it is interesting and valuable. In this new instrument the old dial divisions of predicted weather give place to more minutely classified variations, in keeping with the advanced condition of barometrical study. Monthly tables, showing closely the weather changes during twenty years past, are given as guides, to the extent of showing how the barometer and thermometer registerings during this period compare with present time, and how far such may be applied in arriving at a knowledge of weather about to take place. Admiral Fitzroy's efforts, as practically placed before meteorologists, are fully embodied in his new barometer, which seems to be a mirror of all that is known on weather science. With such an indispensable aid to the study there must be great increase in the number of learners, a fact shown by the public interest evidenced in the new barometer. We may assume that ere long it will decorate many a hall and waiting-room, giving information as well as patience to tired watchers. If we are to be dancing attendance on public notabilities, the least that can be done is that "The World's Barometer and Weather Indicator" may be at hand to relieve the tedium. Counting-houses generally will be instructive in its possession; public institutions require it; in our homes it will be a necessity; and we are of opinion that the heads of educational establishments will do well to explain its principles as a feature of practical every-day life.



ON COMPARING AND ANALYSING THE FORMS OF SHIPS.

BY MR. THOMAS MANSEL.

(Concluded from page 63.)

THE complete investigation of the stability of floating bodies, upon strict mechanical principles, has been published a few years ago by Canon Moseley, who properly named the object of his investigation the dynamical stability of those bodies. Thus, instead of considering the moment of restoration when the vessel is deflected through the given angle, Canon Moseley proposes to calculate the work which must be done during the motion from the upright to the deflected position. Obviously, the more work done in deflecting the vessel through a given angle, the greater is her stability. Now, to do work upon the vessel, we must raise her centre of gravity, or depress her centre of buoyancy; but, in the deflection, we may find that the centre of gravity sinks, or the centre of buoyancy rises. In either case, the corresponding work is antagonistic to the stability, and must be subtracted from the work to be done. Hence, considering the variation of the height of the centres positive when they go to increase the stability, and negative when they tend to diminish it, then the algebraic sum of the variations of height of the centres of gravity and buoyancy. In moving from the upright to the deflected position, multiplied by the weight of the vessel, is the measure of the dynamical stability of that vessel. In addition to this, in all ordinary cases, in the act of heeling we will have water displaced and moved aside. The work involved in this motion goes to increase the dynamical stability, and ought to be included in a strict investigation, but would be much more difficult and uncertain to calculate than even the position of the centre of gravity. These, and other refinements, extending into the dynamical problem of the pitching and rolling of vessels, however interesting in the general investigation of the subject, and valuable for its exact definition, are certainly too intricate for practical operations, and need not be further adverted to at present. One deduction of theory, confirmed by experiment, however, is worthy of notice. It is this: a pressure, such as a sudden and constant gust of wind, will deflect a vessel through twice the angle at which the same pressure would keep the vessel permanently deflected.

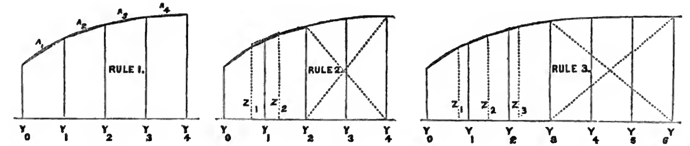
Nearly the whole of the many calculations involved in naval architecture may be reduced to the simple form of finding the areas of certain plane curves; the mode of effecting which may be briefly noticed. In practical works with any pretensions to a scientific treatment we find certain methods, known as Stirling's or Simpson's rules, recommended for this purpose, and their applications fully explained and illustrated by examples. Yet, in actual practical operations, we frequently find a more obvious, though longer and more inexact method in use. All possess the same general feature of determining the area by the measurement of equidistant spaced ordinates; only these are combined in different ways. In the simple rule referred to (which we distinguish as Rule I.) the mean of any two adjacent ordinates multiplied by the common distance is assumed to be the area of the intervening division of the curve, manifestly to the neglect of the small curvilinear areas (such as A_1, A_2, &c., Fig. 4) which may lie between the curve and the line drawn from the extremities of the ordinates considered. On a number of equal divisions, as, for example, the portions of the curve given in fig 4, half the sum of the first and last ordinates, and some of all the remaining ordinates multiplied by the common distance, is the corresponding area of the whole curve. In the Stirling's rule most frequently employed two adjacent divisions are taken at the same time, and of these the half sum of the two extreme ordinates, added to twice the middle ordinate, and multiplied by two-thirds of the mean distance of the ordinates, gives the area of that part of the curve with very considerable accuracy. The proof of this rule generally given is the finding of the area of the parobolic curve which passes through the extremities of the three ordinates, considered. The rule just stated is the strict expression for that area, and it is assumed that our curved line, passing through the same points, can deviate but slightly from it, and must, therefore, enclose a nearly equal area. A simple, graphical illustration may serve to illustrate this rule and the extent of its accuracy better than the tedious mathematical operation. Let Y_0, Y_1, Y_2 (Fig. 5) be the three equidistant ordinates of the pair of divisions considered, and let d denote their common distance; draw two ordinates, Z_1, Z_2, dividing the base into three equal parts, and apply Rule I. to the three divisions formed by the ordinates $Y_0 Z_1$, $Z_1 Z_2$, $Z_2 Y_2$. The area will be $\frac{2}{3} d \left\{ \frac{Y_0 + Y_2}{2} + Z_1 + Z_2 \right\}$: omitting the little curvilinear areas. Now, if instead of Z_1, Z_2, we write $2 Y_1$, obviously we make up the middle small area, and leave an excess which goes towards the deficiency of the first and third generally speaking, the rule gives the area slightly less than its true value). Hence, for the two divisions considered,

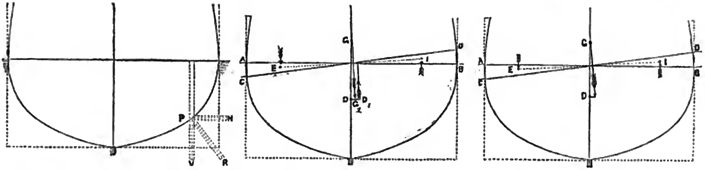
$$\text{area} = \tfrac{2}{3} d \left\{ \frac{Y_0 + Y_2}{2} + 2 Y_1 \right\}.$$

Any number of pairs of divisions might be included at the one operation; thus, for three pairs, the rule would give (see Fig. 6), area =
$\frac{2}{3} d \left\{ \frac{1}{2} (Y_0 + Y_6) + 2 (Y_1 + Y_3 + Y_5) + (Y_2 + Y_4) \right\}$. To apply this rule, the number of divisions must be even, or in pairs. We distinguish it as Rule II.

The second Stirling's rule in general use takes the divisions in groups of three (see Fig. 6), and, as in the former case, for a simple graphical proof, the base of the equal spaced ordinates Y_0, Y_1, Y_2, and Y_3 of the first group is divided into four equal parts by the ordinates Z_1, Z_2, and Z_3, the common distances of which are obviously $\frac{3}{4} d$, and Rule I., applied to the four divisions $Y_0 Z_1$, $Z_1 Z_2$, $Z_2 Z_3$, and $Z_3 Y_3$ gives the area approximately, $\frac{3}{4} d \left\{ \frac{Y_0 + Y_3}{2} + (Z_1 + Z_2 + Z_3) \right\}$: neglecting the little curvilinear areas. Now, if for $(Z_1 + Z_2 + Z_3)$ we write $\frac{3}{2} (Y_1 + Y_2)$, this latter sum differs from the former by a slight quantity, which goes to compensate for the omitted little areas, though, as will be seen by inspection of Fig. 6, to a less extent than by the former rule.

MANSEL'S FORMS OF SHIPS.





This is generally the case, and hence the former rule is to be preferred, unless, from the number of divisions being odd, and a *multiple of three*, this, which we distinguish as Rule III., becomes applicable when Rule II. is not so.

The expression for the area considered is therefore, by Rule III.,—$\frac{3}{4} d \left\{ \frac{Y_0 + Y_3}{2} + \frac{3}{2}(Y_1 + Y_2) \right\}$

Or, taking in another trio of divisions to exhibit the complete form, as in Fig. 6:

$$\text{area}_0^6 = \frac{3}{4} d \left\{ \frac{Y_0 + Y_6}{2} + \frac{3}{2}(Y_1 + Y_2 + Y_4 + Y_5) + Y_3 \right\}$$

To conclude this subject: a curvilinear area being divided into any number of parts, and the corresponding ordinates measured, the area is as follows:—

RULE I.—*Any Number of Divisions.*

Half the sum of the first and last, and the sum of the remaining ordinates, multiplied by the common distance.

RULE II.—*Pairs of Divisions.*

Half the sum of the first and last, twice the mean ordinate in each pair of divisions, and the remaining ordinate, summed and multiplied by two-thirds of the common distance.

RULE III.—*Trios of Divisions.*

Half the sum of the first and last, three half times the sum of the two mean ordinates in each trio, and the remaining ordinates, summed and multiplied by three-fourths the common distance.

In like manner we might form rules for the successive combinations of divisions; the coefficients would be simpler than those given by the mathematical investigation of the arrears of the parabolic curves passing through the same points, and would certainly represent the areas of our usual curves in ship-building with quite as much accuracy.

As a simple comparison of results of the above rules, measuring the ordinates of the curve given in the figures with a certain scale, we obtain:

By Rule I. Area = 122·175.
Rule II. „ = 122·830.
Rule III. „ = 122·805.

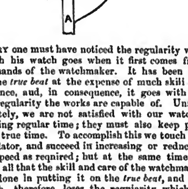
Doubling the number of ordinates gives:

By Rule I., area = 122·588. So that we should, in this case, require to measure about three times the number of ordinates to get the same accuracy with Rule I., as with the others.

Ships present many varieties of size, and about as many of form, and we see some of the peculiarities of form carried to an extent that must, to a marked degree, influence their behaviour at sea. That such differences should exist is not to be wondered at, seeing that the connection between the form and the properties of the vessel is ill understood; and knowing, further, that the best designed ship is only the most judicious compromise between conflicting elements—excellence in one property being generally conferred at the expense of one or more of the others. I need not, therefore, insist upon the importance of some general principle for comparing the forms of vessels, were we only to view it in the light of a simple practical question, of registering those forms for reference and guidance in future constructions, without ulterior views as to analysing them, with the object of arriving at some more definite ideas as to the various intricate questions involved. We compare ships in many ways: for example, by builders' tonnage, which gives but a very general idea of length and breadth. The recent mode adopted for the registration of gross tonnage gives a correct measure of the internal capacity of the vessel; and, taken in connection with the principal dimensions, would enable us to arrive at some notion of the comparative fineness of different vessels. For a strict comparison, however, we should require drafts on the same scale; and further, the various water-lines and sections would require to be placed in relatively proportional positions, which I believe is not the usual practice among shipbuilders. One simple and obvious plan would be to divide the moulded depth of the vessel, say into ten equal spaces for the positions of the water-lines, and the length, for greater uniformity, say, inside the stem and stern-posts at half the moulded depth, into ten or twenty equal parts for the position of the body plan sections. Forming drafts in this way, on a uniform system, would enable comparisons to be made between different vessels in a much readier way. Complete drafts, however, on any reasonable scale, are very unwieldy. In the hands of a competent person, the body plan is all that is required for the comparison or calculation of any ship; and it appears to me that for ships as usually built, the body plan formed with ten equal-spaced divisions of the water-line, as shown in Fig. 7, is sufficiently accurate for all practical purposes of comparison and register of form. A next obvious step would be, to form a table of the breadths at the various water-lines, with rail breadths, sheer, and other elements; and it is not difficult to perceive, that a more direct comparison, in respect to form, would be obtained by taking comparative proportions, instead of the actual dimensions. This is easily done by taking the half-breadth as the unit of length, and tabulating all the measurements in terms of this unit.

PROFESSOR AYTOUN'S WATCH REGULATOR.

By ROBERT AYTOUN, W. S., F.R.S.S.A.*



EVERY one must have noticed the regularity with which his watch goes when it first comes from the hands of the watchmaker. It has been put on the *true beat* at the expense of much skill and patience, and, in consequence, it goes with all the regularity the works are capable of. Unfortunately, we are not satisfied with our watches keeping regular time; they must also keep pace with true time. To accomplish this we touch the regulator, and succeed in increasing or reducing the speed as required; but at the same time we undo all that the skill and care of the watchmaker had done in putting it on the *true beat*, and the watch, therefore, loses the regularity which it owed to that circumstance alone. This position I shall now endeavour to establish.

Besides the length of the hair-spring on which the *rate* of the watch depends, there are two other adjustments of that delicate part of a watch of great importance. The one is, that the hair-spring shall be held at the fixed end in such a manner that the balance-arbor attached to the free end shall rest in its pivot-holes freely, and without compulsion. It is evident, that if the pivot-holes coerce the pivots of the balance-arbor, there will be an amount of friction quite incompatible with the delicate duty they have to perform. The other adjustment of the hair-spring is, that it shall hold the balance-wheel when at rest in a neutral position, so that the latter shall have to revolve as far to the one side as to the other, in order to let a tooth escape. In this position the watch is on the *true beat*; the beats succeed each other after the expiration of exactly the same interval of time, and the watch goes with the greatest regularity that the works are capable of. Indeed, it is not too much to say, that the regularity of the watch depends as much on this circumstance as its rate of going does upon the length of the hair-spring.

---

* Read before the Royal Scottish Society of Art, [illegible]

Now, in moving the regulator for the purpose of altering the rate of going, the regulating pins projecting from it are sure to press the hair-spring either to the one side or the other, and consequently force the pivots of the balance against the pivot-holes. This destroys the first adjustment noticed above, and must be remedied at all hazards. For this purpose the hair-spring is twisted backwards and forwards by means of pliers, until it no longer presses the pivots of the balance against the pivot-holes. But in doing this, the second adjustment, that intended to give the *true beat*, is completely destroyed, as is clearly shown by the model on the table, of which the figure is a drawing; the slightest twisting of the hair-spring causes its inner end *B*, purposely drawn into a straight line upwards, to make a new angle with the bar *AA*, showing thereby the new face which the balance will be constrained to present to the escape-wheel, producing unequal beats, and all the irregularities which may be expected from a *halting motion*. This explains a circumstance which every one must have noticed —the reluctance of watchmakers to turn the regulator sufficiently; they content themselves with gentler touches than the impatience of their customers demands, for they know by experience the danger of setting the watch *off beat*, if they were to move the regulator to the degree warranted by its rate of going.

The addition which I propose to the regulator is a slide, carrying the regulating pins, which moves in a groove of the regulator *BC*. By its means the regulator may be moved with perfect safety to the degree rendered necessary by the variations from true time, *even to the limits of its range*; for the compression of the hair-spring thereby occasioned can be at once removed, by shifting its slide in the grove until the pin cease to compress it. Thus the necessity is taken away of tampering in the slightest degree with the hair-spring, which, when once adjusted, need never be touched again, until in process of time, it returns to the watchmaker's for repairs or cleaning.

THE NEW CUNARD STEAMER — THE CHINA.

A new first-class steamship, the China, has just been added to the fleet belonging to the Cunard Company. The China was built in Glasgow, and tested on the Clyde, on Tuesday week last, and gave great satisfaction. On the following day she started for Liverpool, and during the earlier portion of her voyage proceeded against a stiff head wind, notwithstanding which she made the run from the Cloch Lighthouse, near Greenock, to the Bell Buoy, at the mouth of the Mersey, in 12 hours 26 minutes, with steam at 12 lbs. pressure, being at the rate of 14 nautical or 16⅛ statute miles per hour, throughout the whole run, a rate of speed which is deemed in every respect satisfactory.

The China is an exceedingly handsome, and large vessel, having very fine lines both fore and aft. She is fully barque-rigged, and is fitted with Cunningham's patent reefing apparatus; and also with Clifford's patent apparatus for lowering her boats, two novelties in the Cunard company's mail steamers. In length the China measures about 350 feet over all, being 326 feet between perpendiculars; her moulded breadth is 40 feet 6 inches; and her depth is 27 feet 6 inches. She is a three-decked ship, with fully 8 feet in height between the floor and the ceiling of each of them; and her saloons, which are also 8 feet high, are fitted up under a hurricane deck, running from stem to stern of the ship. The main or after saloon is about 70 feet in length by 20 feet wide; the forward saloon is of equal breadth, but shorter. In front of this latter is the post-office, or letter sorting apartment, a tastefully and most commodiously fitted up "snuggery," of very considerable dimensions. The saloons, like those of the other Cunard mail steamships, are richly and elegantly furnished, the hangings and other upholstery being of crimson and gold damask. The sleeping berths for passengers are on the main deck, below the saloons, and the Board of Trade measurement for passengers in the China gives space for 268 first-class and 771 second-class, or forward passengers, giving a total passenger capacity for 1,039, by the Board of Trade certificate. While this is her passenger capacity, it may be well also to state that she has been reported, on measurement by the Government Shipwright Surveyor, as competent to carry 1,500 troops, without dismantling her saloons, or taking down her after cabins.

Another instance of the prudent forethought which has been bestowed in the construction and fitting up of this fine vessel will be found in the fact that her fittings are all made moveable, and such as can be taken down and replaced with celerity, and without injury: and, further, that suspension rods run along all her beams, to which hammocks can be slung without any necessity for unscrewing a bolt, or driving a nail, should the special service of the country require her to be used at a troop ship.

The China, like the Scotia and the Persia, is an iron-built ship, very strongly framed, and amply secured by strong water-tight bulkheads. Her gross tonnage is 2,529·01 tons; allowance for propelling power 989·40 tons; registered tonnage 1,539 61. She is propelled by two engines on the oscillating principle, with an aggregate of 550 horse-power. The China was built and engined by Messrs. Robert Napier and Sons, of Glasgow, in a manner worthy of their high reputation as marine architects, builders, and engineers. She is to start from Liverpool on her first voyage for New York with the mails on the 1st of March, and, judging by her appearance, excellent fittings, and preliminary performances, there can be no doubt that she will prove herself a worthy compeer to the noble sisterhood of steamships with which she is allied.

NOTES ON THE INTERNATIONAL EXHIBITION.

It is contemplated to open a Photographic Exhibition, independent of, but not opposed to the Great International Exhibition. No plan has been decided on, but it is probable that the Photographic Exhibition will be held at the Crystal Palace, Sydenham.

Mr. Campbell, the Local Commissioner for Japan, says the *Society of Arts Journal*, has delivered a general catalogue, which promises an excellent show on the part of that little-known country. The works of industry and art in which the Japanese most excel are of great variety. Many of them will not only bear comparison with the best workmanship of Europe, but in many points they cannot be rivalled. Manchester and Birmingham, London and Paris, will each find in a Japanese collection articles that either cannot be produced in their workshops, or only at a cost that would make them practically unsaleable. Many of these articles, however, with all their delicacy of workmanship and perfection of material, such as the finer kinds of eggshell, porcelain, and china; the inlaid, enamelled and chiselled metalwork; the crape silk fabrics and the lacquered ware, are procurable in Japan, especially by the native purchasers, at very moderate prices. Others again are very costly, and can only be obtained at prices which in Europe would probably be thought far beyond their value. These are chiefly specimens of old lacquer, old bronzes—the finer kinds of ivory carving, swords, and armour, of which latter class the armed retainers of the Daimios, and the feudal chiefs themselves are extravagant admirers and collectors. When wealthy, they will give any price for an approved weapon by a maker of great repute.

On Monday last, says *the Times*, before the building was formally delivered over, it underwent a most severe test as to its strength of galleries and stairways, &c. Before the dimensions of the columns, girders, and timber rafters of the building were decided on, a preliminary test was adopted by crowding 80 "navvies" on to a weigh-bridge of 79 feet (superficial) space. This number of very heavy men gave a weight of 153 lb. to the superficial foot—a weight that, broken up as the floors and galleries will be by counter space, and allowing for the number of women and children in even the densest crowd, could not by any possibility come upon any one part of the building. When, therefore, the size of the columns and girders was decided on it was determined to load them to the extreme strain of 140lb. to the foot before erecting. At this weight the deflection of the trussed beams was trifling, and on the removal of the load the rods recovered themselves to the fraction of an inch. But, not satisfied with this, the still more severe test of the vibration and concussion produced by a body of men marching was resorted to on Monday last. The testing occupied nearly three hours, and during that time a body of 400 "navvies" went through all the picture and side galleries and stairways of the building, first marching, then at a quick march, and then at "the double," stamping hard. The greatest deflection of the iron beams under this heavy ordeal was only one-eighth of an inch, and of the iron and wooden trusses of only from three-eighths to five-eighths. In fact, all the galleries showed a firmness which even those who were acquainted with the heavy test they had previously undergone were not prepared to find. Opinions as to the great strength of the interior were, therefore, definitely set at rest by all parts of the structure bearing this severe trial without complaint or sign of weakness of any kind. On Saturday the last centres were removed from under the domes, and they were left to stand alone. Every part of these huge works was found, on examination, to be as rigid as a single bolt. Much of this is, of course, due to the perfection of workmanship with which the Thames Iron Company has turned out all the component parts of each structure, but a good dead is also owing to the extreme care which Mr. Hussey, and Mr. Ashton have taken respectively in the erection of the eastern and western domes.

The western *annexe*, for machinery in motion, is at last, we are glad to say, getting into a forward state of readiness, though still by no means on a par with the progress of the rest of the building. Three square sewers, if we may so call them, have been built along its entire length for the steam, waste, and exhaust pipes. These are all constructed of very solid brickwork, and as carefully finished as the noble entrances under the domes themselves. Along the edges of these rows of sunk brick walls a tramway will be laid, on which the heavy machinery and locomotives will be moved up to their places. Still, apparently there is no preparation made for the most difficult task of all—that of fixing the shafting by which the machinery is to be driven. Fixing the shafts to the light wooden framework of the *annexe* itself is, of course, out of the question, and it is equally certain that there is no proper room for them, with their drums, where the steam pipes are to be laid.

A new work bearing the title of *The Jeweller's, Goldsmith's and Watchmaker's Monthly Magazine*, has been commenced. It is illustrated with ornamental designs and working drawings.

WOOD PLANING MACHINERY.[*]

By Mr. John Norman.

Since its first introduction into this country, the flooring machine has undergone various changes in design. What we may call the original flooring machine was the invention of Mr. Malcolm Muir, of Glasgow, who took out a patent for it in the year 1827. In this machine the wood being planed was led through by hooks attached to an endless chain passing over pulleys at each end of the machine, and circular saws were used for grooving and feathering the edges of the board.

The machines used before Mr. Muir's machine was introduced, were very imperfect, comprising in each case only a revolving scutcher or adzing knife, the board afterwards being put on another machine for the purpose of getting the edges dressed. In these machines the board was led through by rollers driven by spur gearing, and the scutcher was placed on the top in a moveable frame, and held down by weighted levers.

In 1838, Mr. William Norman, of Glasgow, applied five pair of rollers to one of Mr. Muir's machines, for which patents for Britain were obtained; thereby doing doing away with the pitch chain and hooks, as great inconvenience and loss was found to exist with their use in planing thin boards, from the hooks tearing them up. Mr. Norman afterwards applied cutters for grooving, retaining the circular-saws for feathering the edges of the boards. The machine upon which these alterations were made is still at work in Messrs. Baird and Brown's saw-mills, Port Dundas.

The above engravings represent a flooring machine, embodying all the most recent improvements, as constructed by Messrs. Norman and Co., and erected by them at Allea. There are five pairs of rollers, 12 inches in diameter and 12 inches long, driven by bevil gearing. The upper rollers are held down by springs, similar to coach springs, and are lifted to suit different thicknesses of wood, varying from half an inch to four inches, by means of screws turned by hand wheels. Each screw works in a nut formed on a buckle or strap passing round the under side of the upper roller and bearing in a recess cast in the standards. The bushes of the under rollers are put in from the under side, and are held in position by malleable iron plates, and are adjusted by screws. This arrangement makes the under rollers very easy of access; all that is required to get out the rollers being the removal of the malleable iron plates. The plane bed in this machine is of the usual form, having three irons, which have in plan an angle of 45°. In some machines, however, the bed is cast separately, and the plane irons are placed in a movable box. The cutter heads are formed with three short arms, each being furnished with cutting irons for grooving and feathering the edges of the board. The cutter heads are adjusted to the required breadth and thickness of flooring by screws. The thicknessing scutchers, consist of a pair of revolving cutters or knives fastened to two set of malleable iron arms, and adjusted by thumb screws. The scutcher is adjusted for different thicknesses of wood by screws connected by a shaft passing across the machine, and with bevil wheels worked by a hand wheel.

The main driving shaft is fitted with pulleys for driving the feeding rollers at two speeds, 30 and 46 feet per minute, and also with a pulley for driving the cross shaft at the end of the machine; on which last are the pulleys for driving the grooving cutters and thicknessing scutcher. The grooving cutters make 3,000 revolutions per minute, and the thicknessing scutcher 2,500 revolutions per minute. This machine has been in operation for the last twelve months, giving the greatest satisfaction, being able to turn out 1,300 yards of flooring per day.

In the discussion which followed—

Mr. J. Brownlee said that the earliest successful application of revolving cutters for dressing wood was by Mr. Bramah, who in 1802 patented a machine which is to some extent still used. In that machine the timber was passed beneath a horizontal wheel or face plate carrying gouges or knives, and running upon a vertical spindle with considerable velocity. It was not, however, until about the year 1827 that a machine was brought into practical use for the working of flooring boards, which was patented by Mr. Malcolm Muir; and, as Mr. Norman had said, the boards in Muir's machine were drawn over fixed plane irons by an endless chain, the tongue and groove being at the same time formed by small circular saws running upon five different spindles; but, with the exception of a narrow strip along the edges, this machine did not operate upon the back of the board, nor otherwise reduce it to an equal thickness. In the year following (1828) another machine of an entirely different character was patented by Mr. Woodworth in the United States of America, where it was now extensively used, and so generally preferred as almost to have superseded all other methods, especially since the expiry of the patent, which by two renewals continued in force for a period of twenty-eight years, and therefore only expired in 1856. In the Woodworth machine the boards were fed by rollers. No stationary plane irons being used, the boards were dressed smooth on the upper side and at the same time reduced to an equal thickness by knives fastened to arms (as represented by Mr. Norman), or to a block mounted upon a horizontal spindle which rotated with great rapidity. The tongue and groove were similarly formed, by rotating cutters mounted upon two vertical spindles, one cutter head operating upon each edge of the board. The whole operation of facing, thicknessing, and tongueing and grooving, was thus performed by rotating cutters mounted upon three different spindles.

About the year 1831 the rotating thicknesser of Woodworth—that is, the dibber or scutcher as described by Mr. Norman—was re-invented or imported and patented by Mr. Muir, up to which time the work produced by Muir's machine was very incomplete.

Some time previous to the expiry of Mr. Muir's second patent, a machine was constructed and put in operation in Glasgow, by Mr. John Robb, in which he applied the feeding rollers and tongueing and grooving cutters of Woodworth; and being under the necessity of evading Mr. Muir's patent, he substituted for the rotatory dibber of Woodworth the revolving wheel of Bramah. Other machines, in which similar means were adopted, were about the same period made by Messrs. Norman & Clinkshill, and by Mr. Thomson, of Edinburgh. On the expiry of Mr. Muir's patent, the feed rollers, tongueing and grooving cutter, and dibber of Woodworth came into general use. The chief makers of those machines were Messrs. Norman & Clinkskill, and the late Mr. M'Dowall of Johnstone, by whom many excellent machines were made and great improvements were effected.

The modern machine, although scarcely presenting in its external appearance any resemblance to those originally invented by either Muir or Woodworth, was essentially a combination of both. For finishing the face of the board, the stationary planes, as introduced by Muir, were still retained, while the tongueing and grooving cutters—the thicknesser or dibber, and the feed rollers, operated precisely in the same manner as patented by Woodworth in 1828. The machine had undergone many modifications in the hands of different makers, but these modifications referred only to matters of detail and arrangement, the operating principle being the same in all.

In the earlier machines, proper attention was not bestowed upon the perfectly balancing of the different rotating parts of the machine, which was of first importance, and required not only great care on the part of the maker of the machine, but also upon that of the operator, who required to notice that the knives which he fastened upon opposite sides of the rotating block, were always perfectly equal in weight. Negligence in this respect rendered it impossible to make good work with any machine.

The necessity of this observance was, however, now generally understood. It was not, however, so well known that it was almost equally necessary that the belts by which the rotating cutters were driven should be as nearly as possible of equal weight throughout, without any clumsy or heavy joinings. Belts running at a moderate speed were sometimes joined by copper rivets, but this method of joining belts which run at high velocities was quite unsuitable, as the weight of the rivets not only communicated a vibratory motion to the machine, but also very soon destroyed the belt itself. After properly balancing the various rotating parts of the machine, the chief improvements which had been effected referred to the method of forming and fastening the cutters so as to facilitate the changes which were required for the various kinds of work, also to the means of adapting the machine to the various thicknesses of material, and in the methods of arranging the gearing by which the feed rollers were driven, so as to accommodate itself to the different positions of the upper rollers, which rested upon the wood, and rose and fell as the thickness varied. In the machine before them the rollers were driven, as would be observed from the drawing, by bevil wheels. The wheels which geared into those which were fixed upon the upper rollers slided upon the upright shafts, being supported by the ends of the shafts of those rollers, which ends projected into a groove cut out round the boss of the wheels sliding upon the upright shaft; these wheels were thus held always in the same position with respect to the upper rollers, along with which they rose and fell.

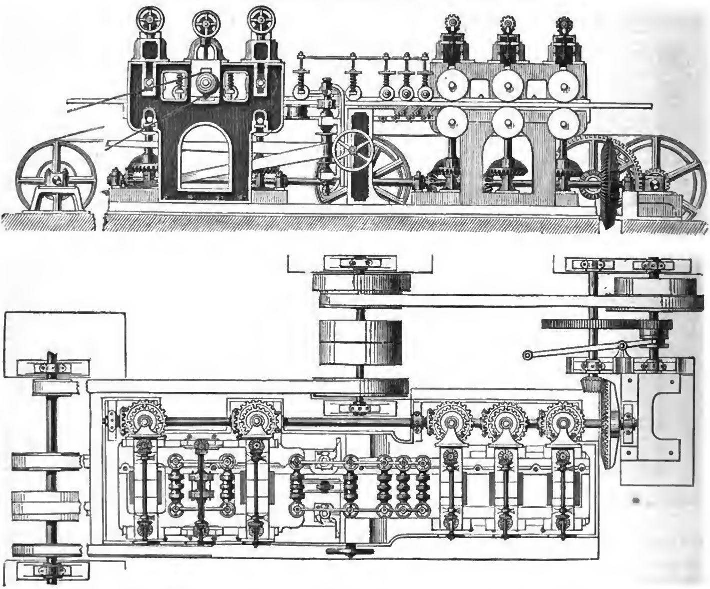
Although many machines had been constructed in this manner, he did not think the method commendable. The wheels which drove the rollers were by this arrangement limited to the same diameter as the rollers, which not only rendered the teeth liable to fracture from the strain they had to bear, but from the smallness of the wheels, an extra pressure was also brought upon the journals and bearings of the rollers. The bosses of the wheels which slided upon the upright shafts were also liable to wear, and become loose and shaky. The grooves in the bosses of those wheels, and the ends of the roller shafts which turned in those grooves, and by which the wheels were supported, were no less objectionable. In a machine for working mouldings made for him some years since by Messrs. Forrest & Barr, and also in a flooring machine which he had more recently had made by Messrs. Smith Brothers & Co.—the method which he adopted for driving the rollers was by spur gearing. The wheels upon the roller shafts were much larger in diameter than the rollers. In a line nearly horizontal with the rollers, a shaft extended across the machine between each pair of rollers, which shaft carried a pinion which drove two rollers—a roller wheel gearing into each side of the pinion. When the upper rollers rose or fell, the depth which the teeth of the wheel and pinion geared into each other varied slightly; but as the extreme thickness of wood which passed through the machine seldom exceeded four inches the rollers were not required to rise or fall more than two inches above or below the level of the intermediate shaft, and this did not appreciably effect the proper action of the teeth. Within the last twenty-five years he had had in his works in this country and in America, eight planing machines, no two of which were constructed alike; but he conceived this mode of driving the rollers to be the most simple and substantial which he had tried or seen. A number of samples of mouldings were upon the table, worked by the machine made for him by Forrest and Barr, which had not been sand-papered, but were in the same state as on leaving the machine, and he thought they would be admitted to be as smooth as if dressed with the finest plane.

Mr. J. Russell said the difference between the planing machines now in use lay chiefly in the

---

[*] (Read at the Institution of Engineers in Scotland, Jan. 8th, 1862.)

NORMAN'S WOOD PLANING MACHINERY.

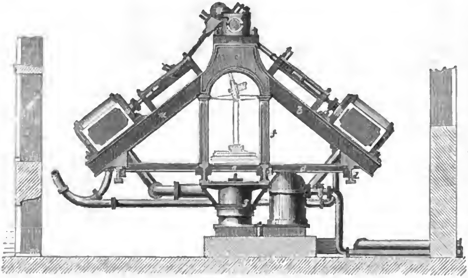


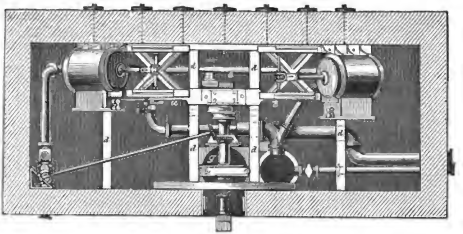
gearing of the rollers; and he thought they ought to enquire whether the bevil or spur gearing—as pointed out by Mr. Brownlee—was the best. It appeared to him that the bevil gearing was correct in action, whatever might be the position of the upper roller. With the spur gearing the action was not absolutely correct, but yet it might be sufficiently so for all practical purposes; whilst if the bevil gearing were apt to give way on account of the small size to which it was limited, that would go far to condemn it. They had been told that the machine had worked well, and he would like to know whether the bevil wheels were, in practice, found liable to break. In the event of parties requiring a machine of this kind, it would be well if they could get some information about this—the only point of difference between the various machines. Any practical person who looked at the original machine of Mr. Muir, and compared it with the present machine, would observe that they were, perhaps, very few machines upon which so many improvements had been made. He happened to be at the making of one of the earlier machines at Leith about the year 1832; and when it was started there was scarcely ever a day passed that a belt did not break. There was a drum and a considerable number of belts in use, and some of them were continually breaking. The pitch chains which the hooks split away the wood at the ends, and detention from that cause was common. In looking at the two machines, great improvements appeared to have been made upon the original one.

Mr. T, Davidson asked how many adjustments were required in altering the machine to cut from one thickness and breadth to another thickness and breadth.

Mr Brownlee said that to alter the machine to cut a different breadth of board only required the turning of a wheel, every turn giving an eighth of an inch; but in altering the thickness, all of the tongueing and grooving cutters had to be changed. The thicknessing dibber and feed rollers had also to be elevated, as well as other holding-down rollers or guides, all of which changes required some considerable time. The machine had, however, been greatly improved in this respect, by so combining several of the parts that they rose and fell together. In some machines the feed rollers were elevated singly, whilst by various arrangements in others they all rose together by simply turning a wheel or handle. Both of the machines mentioned which he had last had made were so constructed; but in each machine this was effected by a different method—the arrangement by which this was effected in the last having been designed by the makers, Messrs. Smith Brothers & Co. But besides the feed rollers, there were others, as would be observed in Mr. Norman's drawing, for pressing the board down upon the plane bed; and those rollers, as far as he was aware, had always been raised separately; whereas, in his last machine, he caused them to be supported in a frame, which frame was itself carried by the four bushes of the adjoining feed rollers, along with which it rose and fell, and thereby those rollers rose and fell along with the feeding rollers. By this arrangement, not only was time economized, but an invariable pressure was also brought upon the back of the board, which was otherwise ever changing with inequality of thickness when those rollers were held down by springs, as was usually the case. In comparing the original machine of Muir with those now constructed, he thought very great progress had been made; and, with the exception of the stationary plane of Muir, he did not, in the present flooring machine, see a single feature of Muir's original machine remaining. And in the moulding machine, which was a more delicate and finer piece of mechanism, those planes were not required. But although this last machine operated altogether on the principle patented by Woodworth, it was only within the last few years that it had been brought to that perfection, and managed with that carefulness, which a well finished moulding demanded.

MCNAUGHT'S METHOD OF SUPPORTING STEAM ENGINES.





MCNAUGHT'S METHOD OF SUPPORTING STEAM ENGINES.

Patented by W. McNaught, Engineer, Manchester.

This invention relates particularly to a certain description of direct acting steam engines, being principally applicable to "diagonal" condensing engines, with either one, two, or more cylinders, and consists in such an arrangement of framing as to dispense with all the usual stone foundations, the stability of the engines depending upon the "side walls" of the engine house. The framing of the engine is attached by bolts or other convenient means, to the "side walls," and transverse beams are provided, extending from each "side wall," to assist in supporting or carrying the engines; such beams may be of iron or other material. The air pump and also the condenser may be supported or suspended from the cross beams.

Fig. 1 is a side elevation, illustrating the improvements in supporting steam engines; Fig. 2 represents a plan view of the same. The framing is constructed and consists in two principal pieces *a* and *b*, with two vertical stays *f*, *f*, bolted or otherwise joined together at *c*; this framing is secured to transverse beams *d*, *d*, which are securely fixed in the side walls of the engine house, and also fitted and bolted thereto. Tie beams are provided to secure the transverse beams; these beams may be formed in one piece, and fixed above or below the transverse beams, or a strong plate may be used instead of the tie beams. Although four transverse beams are shewn, a less or greater number, as may be considered requisite, may be used. The vertical stays *f*, *f*, should be double, and joined with diagonal braces, and secured to the framing and side wall to give greater stability. These stays may be used as fixings for the guides of a third cylinder, or for the air pump, if worked direct from the crank pin. Although two vertical stays are shewn and described, a single central one may be used, to which the two principal pieces *a* and *b* are to be bolted. The air pump *g* is fixed to the two centre transverse beams, and may be either single or double-acting; in this case it is represented as single-acting, and motion is communicated by an eccentric on the crank shaft, but it may, if preferred, be worked direct from the crank pin. Or, in the event of running at very high speed, two or more smaller air pumps may be used, so as to mitigate and divide the shock, and these may be worked by an eccentric or eccentrics or any other means. The engine is represented in the above engravings as a single expansion engine with two cylinders placed diagonally, such being generally preferred, and fitted with superimposed "cut-off" slide valves. The "cut-off" valves are actuated by a separate eccentric, and each eccentric actuating two valves, and may be made to actuate so many valves as there are cylinders to the engines; but the engine may be made to work on the compound principle, by allowing one or more cylinders to pass their steam to the other cylinder or any number of cylinders, and from thence into the condenser.

Mr. Cobden has promised to bring the decimal coinage question before Parliament during the ensuing session.

ON SOME RECENTLY-EXECUTED DEEP WELLS AND BORINGS.

By George R. Burnell, C.E., F.G.S. F.S.A.

(*Continued from page* 81.)

It may be worth while to call attention to the mechanical means adopted by M. Kind in sinking a boring of the large diameter of 2 feet 4 inches, to the enormous depth of nearly 2,000 feet from the surface. The work was commenced by a shaft, as usually is the case, and after it had been sunk to a depth of about 50 feet, the boring commenced, and was continued with as nearly as possible the same diameter to the bottom. M. Kind employed for this purpose what may be called rods with releasing joints, very closely resembling the joints introduced by Œnyenhausen, which allowed the cutting portion of the tool to be raised a certain height, and then to be released automatically; this arrangement was adopted in order to avoid the lashing of the sides of the bore by the long rods, and to regulate the force of the blow. The cutting tool used by M. Kind also differed from the tools generally employed, for it consisted of a single or a double trepan, according to the nature of the ground, instead of the ordinary chisels and augurs. A patent was taken out for these tools by M. Kind, No. 13,478, of the year 1854, the printed specification of which contains a series of engravings of the various modifications proposed for the various kinds of rocks; in the *Annuaire Scientifiqe* for 1861, illustrations will also be found of the ordinary trepans and of the slide joints. M. Kind is able, by these combinations, to strike as many as twenty blows in a minute with the greatest regularity at a depth of 2,000 feet. The patent of 1854 specifies also certain methods of lining the sides of the borings; but it must be confessed that they do not seem to me to possess any great merit, and indeed M. Kind had more difficulties to encounter at Passy from the collapsing of his tubes, than from any other cause. It is a common error of well borers to undervalue the effort exerted by clays swelling when charged with water; and the great delay encountered in sinking the Passy well were precisely caused by the false economy introduced in the execution of the tube linings. The time actually employed in sinking the Passy well was nearly the same as that employed at Grenelle; in the former instance it was 6 years 275 days, in the latter it was 7 years 90 days. The cost of the Grenelle well, as above stated, was £14,000; that of the well at Passy was £40,000, but it must observed that the quantity of water, delivered at the same height in the two cases, is ten times greater at Passy than it is at Grenelle; the rates of delivery are, in fact, nearly in the direct ratios of the diameters.

I have not been able to learn whether the artesian wells of Elbœuf and of Rouen have been affected by the completion of the new well at Passy, and at present I am inclined to believe that they may escape this action, on account of their proximity to the entering ground of the lower green sands, on the western margin of the cretaceous basin. At Tours, however, so many wells have lately been sunk (in an early addition of M. Degoussé's excellent *Guide du Sondeur*, that gentleman mentions that he himself had executed no less than sixteen of them), that the subterranean supply is becoming exhausted, and, as in the case of the wells supplied by the basement beds of the London clay, the lower geeen sand wells are gradually losing their artesian character. In two wells also, at Evres and Ferriéres, the subcretaceous formations yielded no water; and in the latter the bore was even carried to a depth of 30 feet in the great oolitic, or jura limestone series, without obtaining a supply. I call especial attention to this fact, because it illustrates again the uncertainty at all times overshadowing the execution of the first deep wells in a particular district, and that the stratum which yields water in one locality is likely to be unable to do so in another. The enterprising gentlemen who are engaged at the Hastings well should bear this fact in mind, and though I believe that after they shall have traversed the lower members of the Wealden series, they are more than likely to find the upper or Portland oolite, which is of sufficient water bearing power to ensure them a good supply of water, they must also be prepared for disappointment. The Hastings well is already 553 feet deep, still in the Hastings beds, and as these have never yet been traversed, it is impossible to say whether they will be found to be seven or seventeen hundred feet thick. Most probably the former guess will be found to be the more correct, because the town of Hastings is situated at a low horizon in the series of Weald beds; but all operations of this description at Hastings must for the present be conducted in doubt as to the ultimate result, however strong may be the hopes of success. The character of the strata already traversed, and of those likely to be met with at Hastings, leads me to believe that M. Kind's processes would be particularly applicable there, but the success of such an operation would still be a mere matter of speculation, such as ought to be left to private enterprise.

I dwell a little on this point, because the Board of Guardians of Brighton are engaged upon a similar experiment, at a place called the Warren Farm, near that town. It is not my place to criticise the mode of execution adopted in carrying on this work, but I cannot refrain from saying that there are many things about it which seem to me to be in opposition to the opinions now entertained by scientific engineers, and I gravely suspect that, even if water from the subcretaceous formations should be obtained at this well, it cannot, by any possible chance, rise near the surface, which, at the Warren Farm, is not less than 410 feet above the mean tide level. It is inexplicable to me also, that this well should be continued by means of a shaft, at the great depth already reached, instead of by means of boring; and I regret bitterly to see an experiment, which has been carried on hitherto with so much spirit, compromised by what I consider the mistaken course latterly adopted. At Brighton, nevertheless, the only chance of securing a supply in the parts of the chalk basin lying beyond the influence of the faults or "cross throws" which have for instance, enabled the Water Works Company to obtain, as is said, one million gallons per day, is to penetrate the chalk to the lower green sand. Notwithstanding the cost of the previous experimental borings in the surrounding countries, I am convinced that the cheapest manner of effecting this object would have been to have bored, rather than to have sunk a shaft, and even now the Guardians would do wisely to adopt this course, especially as theirs is really the first experimental shaft or boring on the east bank of the Arum. It is however, a sad peculiarity of the municipal bodies of England that they are always disposed to listen to those whom it it is the fashion to call "practical," in contradistinction to "scientific" men, as though the mere fact of working "by rule of thumb" gave men truer insights into the laws of nature than long study and careful observation. At Brighton this seems emphatically to have been the case, and in a report addressed to, and received by, the Board of Guardians, the opinions of three practical well-borers are quoted as to the probable cost of continuing the well at Warren Farm, but no opinion seems to have been asked from such men as Mr. Hawksley, Mr. Mylne, or Mr. Homersham, who have brought great experience and deep study to bear on the hydrographical conditions of this district on other occasions. It is one of the fashionable theories of the day that a scientific education incapacitates a man for the exercise of a profession, and that the most able men in any branch of art or science are those who have not been brought up to pursue it. Under these circumstances, it may not be surprising, however unfortunate it may be, to find empiricism preferred to science, or that the Brighton Guardians should avoid taking the opinions of really eminent engineers.

In stating, in the previous part of this paper, that I should return to the question of the abnormal beds met with at Highgate, I had especially before my mind's eye the cases of the well sunk under my own orders at Warnham Court, near Horsham; and at Red Hill, by my friend, Mr. Docwra. In the former case, the boring, after it had been carried through the sandstones, clays, and shales of the upper Wealden deposits, passed at a depth of 142 feet from the surface into a bed of red clay and sandstone intermixed. At first, I believed, from the external character of the materials, that they were of the same nature as the beds found at the bottom of the Kentish Town well, and I was supported in this opinion by several distinguished geologists to whom I showed the samples. As the Kentish Town beds were, at the time I refer to (about five years since), universally considered to be members of the new red sandstone series, of course I regarded the Warnham bed as one of the same range. But Mr. Docwra, at Red Hill, after he had traversed the sands and loams of the subcretaceous series to a depth of 438 feet, passed into a bed composed of red clays and particles of red sandstone, which were identical with the Warnham beds, and with some members of the Wealden series. It seems, therefore, to me to be very probable that the Kentish Town beds may be members of the Wealden series, but the solution of this question has simply a geological interest, for alike, the Weald clays, and the new red sandstone clays, are without water; and, under these circumstances, the wisest course to be adopted was to stop the further progress of the works in all such cases as Warnham and Red Hill, unless they were carried on distinctly as philosophical experiments.

The well at Rugby, though it has proved to be, no doubt, a source of annoyance and disappointment, may eventually turn out to be of importance to the commercial interests of the locality. It was commenced with the hope of finding in the new red sandstone series under the lias, some water-bearing strata which might be able to furnish a supply to compensate for the deficiency under which the town of Rugby was suffering, after it had been put to the expense of carrying out the absurd crotchet of the so-called "gathering grounds" system. A boring has here been carried down to a great depth in the new red sandstones of the triassic group, which at Liverpool and Birkenhead for instance, frequently supply large quantities of water. At Rugby, however, the boring at present has only yielded a brackish water, and I suspect that now all hopes of securing the result desired by the Local Board of Health by this well must be abandoned, unless the Board determine upon tubing the bore-hole throughout its length, and upon continuing to sink to a much greater depth. It is possible that, within a moderate distance from the bottom of the present well, stronger brine springs than those now brought to the surface may be found, which it would be possible to evaporate economically for the purpose of salt-making; but a very careful comparison between the strata of this locality and of those near Derby or Droitwich, would be required before any decided opinions could be formed as to the probability of finding soft water within a reasonable distance from the surface at Rugby.

The well at Great Yarmouth, executed by Sir E. Lacon and Co., is of interest, on account of its showing the great depth attained by the tertiary strata on the east of England; but, unfortunately for the spirited proprietors, the results, so far as water supply is concerned, have been "negative." The depth of the tertiaries here was found to be 527 feet, and the first 170 feet of this thickness were composed of recent estuarine and blown sand, deposits of very recent formation. At Norwich, Messrs. Colman are steadily pursuing an experimental boring, which has already passed through the chalk to a depth of 1,158 feet, the upper green sand to a depth of 8 feet, and the gault to a depth of 30 feet; the works have been suspended in this formation on account of some accident to the machinery, but when this shall have been repaired, they will, no doubt, be resumed. It may be necessary to descend 150 feet lower before reaching the water-bearing stratum, but the comparative success of Mr. Lankester Webb's well, at Stowmarket, affords good reason to hope that Messrs. Colman's perseverance will ultimately be rewarded. I do not anticipate, however, that the water will overflow the surface, because the lower green sand is traversed by one of the affluents of the Ouse, near Downham market, at a comparatively low level.

In a paper which I had the honour of reading in this room last year, I alluded to the very successful borings made by the Kent Water Works Company, in the Ravensbourne Valley, and this evening I am enabled to lay before you a section, showing the strata they traversed. One reason for my doing so is, because I have heard that some parties propose, as I said in the opening paragraph of this paper, to sink artesian wells near London for the supply of the metropolis; and I think it desirable to state, for their guidance, that, unless they meet with the peculiar conditions of the faults of the Ravensbourne Valley, they are not likely to obtain a large supply of water from the chalk on the north side of the Thames, whilst there is no chance whatever of their finding water below the chalk. There are, no doubt, copious and beautiful springs given off from the head valley of the Lea and the Coln, both of which rise in, and are fed by the chalk; both those springs may, in almost all cases, be shown to be connected with some geological disturbance of the strata, and the only locality near London where there seems to me to be any chance of obtaining a large quantity of water from the chalk, would be on the left bank (or the west) of the river Lea, somewhat to the north-east of Stratford, because there is about that district a line of disturbance in the chalk parallel to the great fault which brings to the surface the springs lately tapped near New Cross, and those of Grays, in Essex.

Finally, it must be evident to anyone who reads attentively the records of the success and of the failure of the attempts above-mentioned, that the execution of artesian wells is an operation which should only be entrusted to skilful and well-tried men, acquainted with the theory and practice of their art. No such work should be commenced without a careful preliminary survey of the geological and hydrographical conditions of the country extending over a very wide range. This is seldom done, because public bodies, in England at least, do not seem to object to pay for engineers' blunders and miscalculations, but they do object to pay for their study, and it is at once assumed that because artesian wells have succeeded in one case they must succeed in all. But even when the greatest amount of skill and science have been brought to bear on the preliminary investigations for the establishment of an artesian well, it is impossible to predict with any certainty what the result of sinking a shaft or a boring may be in a stratum hitherto untried. Moreover, every artesian source of supply is limited in amount, and even in the case of the Paris basin it would be desirable to watch the effects of the increased draught upon the lower green sand during a dry summer, especially before commencing, as has been proposed, the execution of a large number of wells like those of Passy and of Grenelle.

The student who may desire to obtain a complete view of the subject thus briefly referred to, would do well to consult the works of Messrs. Prestwich, Mylne, Clutterbuck, Homersham, Degoussée, Burat, Hericart de Thury, Garnier, &c., the Transactions of the Institution of Civil Engineers, the Comptes Rendus of the Académie des Sciences, and of "Les Ingénieurs Civils" of France. I am myself under great obligations to Messsrs. Hawksley, Lockwood, Wells, Chamberlain, Docwra, Prestwich, Morris, Snider, and others, for the sections and information so liberally supplied to me.

I may here add that in the number of *La Presse Scientifique*, for the 16th January of this year, I find a notice of a well lately sunk at Columbus, Ohio, U.S., which is not less than 2,577 feet deep.

The thermometer (on the system invented by Mr. Walferdin) registered a temperature of 88°; this would seem to show that the law of the increase of temperature is rather slower in Ohio than it is near Paris. No particulars are, however, given of this important boring.

IMPROVEMENTS IN THE MANUFACTURE OF IRON AND STEEL.

MARCUS LANE, of Washington, D. C., has recently taken out two patents, for improvements in the manufacture of steel and iron. Mr. Lane at first, we understand, devoted much time to an examination of the English process of making steel and the various processes which have been used as improvements to the same, as well as an investigation of the chemical principles which have produced the various changes. Mr. Lane's process consists in a carbonization of bar iron In order to accomplish this so that the steel shall be homogeneous in tenacity and malleability, a long and carefully guarded heating of the metal in close contact with carbon is necessary. This can only be done at considerable expense; and although many and various are the substances which have been invented and used in place of charcoal to carbonize the iron, as before stated, they necessarily require so much careful attention and such an outlay of money as to considerably increase the cost of the steel over the cost of bar iron; beside, the first step taken must be to manufacture bar iron before the process for manufacturing steel can be commenced.

Having become satisfied that the desired object could never be accomplished by improvements upon the English process, Mr. Lane took up the German process, and the two patents above mentioned are the results of his study.

The reader will bear in mind that steel occupies an intermediate position between cast iron, which is an impure carbonised iron, and bar iron, which is a nearly pure decarbonized iron; the cast iron having 6 per cent or more of carbon, steel having from 1 to 1[illegible]ths per cent, while bar iron has only about [illegible]ths of 1 per cent. Now, if this process can be stopped when the metal is decarbonized to 1½ per cent, or to nearly that degree, steel will be the product.

The aim of the German process is to stop at this point, and it is evident that if the article produced was as pure as that produced by the English process, it would supersede the latter in general use, as it is produced as cheaply as bar iron, and therefore avoids the expense of further manipulations. But it has been found that steel thus produced contains impurities which existed in the ore before it was fused, and which could not be driven off without further manipulations. It is evident, therefore, that if these impurities can be removed this process will at once come into general use. Mr. Lane has aimed at accomplishing this result, but it remains to be fully tested by practical experiments to demonstrate whether he has succeeded.

The common mode of manufacturing iron from the ore is as follows:—The ore is first fused and run off into pigs; the pigs are then taken, and re-smelted, by which means the impurities of the metal are driven off, and afterwards passed through the rollers or into the puddling furnace.

The first improvement which Mr. Lane has endeavoured to make was the avoidance of the necessity of re-smelting the metal, and thus make the bar iron at one fusion. In order to accomplish this it was necessary to so improve the process as to compensate for the beneficial changes produced by the re-smelting. This compensation of the beneficial effects of the re-smelting is made by supplying carbon in the necessary quantities, and continuing the intense heat until the iron is made nearly pure. The effects of the re-smelting are owing to the fact that the carbon and the oxygen operate to drive off the impurities in the form of vapour. Of course, it is apparent that a continuance of the supply of oxygen to the fused metal with an abundant supply of carbon will have a similar effect. At the same time it was necessary to bring this process completely under the control of the operator, and leave no part of the manipulations subject to mere chance. It was also necessary that the improved process should be so controlled as to make the changes effected the same throughout the whole mass, and thus render the product of equal tenacity and malleability. Mr. Lane accomplishes this by the following improved process:—

He runs the fused metal from the smelting furnace directly into a refining furnace, which is so placed that the gravity of the metal, as it enters the chamber, gives it a circular or rotary motion. This motion is continued by means of agents introduced at a tangent to the mass of metal, which also operate to rapidly decarbonize the same. But it has been found by actual experiment that, such decarbonization is too rapid to permit the heat evolved to carry off the detrimental impurities existing in the metal, and the result is that the iron produced is found to be brittle and almost valueless. To obviate this imperfection, Mr. Lane introduces carbon in such quantity and quality as may be found necessary, and thus prevents any real decarbonization unless desired, or delays the same until the injurious impurities have been removed by means of the intense heat created by the union of the carbon and the decarbonizing agents in the refining furnace. The following description of the mode of working is taken from Mr. Lane's specification:—

"The carbon is drawn into the vortex or eddy produced by the rotation, and sinking with the metal to the bottom of the refining chamber, is, by the subsequent motion of the metal, diffused through its whole mass—the motion of the rotation being such by the means I employ, as to cause the metal at the bottom to pass to the sides of the refining chamber, thence up the sides of said chamber to the surface, and thence down again to the bottom of the refining chamber—the horizontal rotary motion—the ascent and descent of the metal creating the vortex or eddy into which the carbon is injected, and so in the first instance brought in contact with the surface of the metal, and by the repeated motions of the metal, as above described, finally permeated throughout its whole mass."

Our readers will readily understand that any change thus effected must be uniform and homogeneous. It is also evident that by the introduction of the carbon in greater or less quantities the operator has a perfect control of the fused metal, and can decarbonize the same as rapidly or as slowly as he may see fit.

Mr. Lane also connects the refining chamber with the smelting furnace in such a way that the flue from the same enters the furnace in the form of an additional tuyere, through which the heated gases operate as a hot blast to facilitate the fusion of the ores. It is anticipated that this introduction will effect a great saving in the quantity of coal used.

Mr. Lane appears to have advanced in the right direction, and should his process prove as successful as it promises, the following benefits will be derived:—

1. A better article of cast iron, for by his process he will be able to remove those impurities which at present make it so brittle.
2. The production of bar iron and steel nearly as cheaply as cast iron is produced at present.
3. The production of large masses of steel of uniform tenacity, density, and strength, which certainly cannot be accomplished by the present process, save at a very heavy outlay,
4. The placing of molten metal at the perfect control of the operator as to purity, &c.—*Scientific American.*

MEETINGS FOR THE WEEK.

MON.—*United Service Inst.*, "On the Principles of Rifled Cannon and Projectiles," by J. Lawrence, Esq., at 8.30 p.m.
London Inst., "On the Grecian Drama," by the Rev. C. M. Davies, A.M., at 7. p.m.
Geological School, Jermyn St., "On Applied Mechanics," by Prof. Willis, at 12 a.m. "On Geology," by Prof. Ramsay, at 1 p.m.

TUES.—*Inst. Civil Engineers*, Continued Discussion upon Mr. Samuda's paper "On Iron-plated Ships," at 8 p.m.
London Inst., "On Odours, and the Special Organs and Sense of Smell in Man and Animals," by J. Marshall, Esq., at 3 p.m.

WED.—*Geological Soc.*, I. "On the Drift containing Arctic Shells and other fossil remains, in the neighbourhood of Wolverhampton," by the Rev. W. Lister, M.A. II. "On Split Erratic Blocks," by James Smith, Esq., F.R.S. III. "On the Ice-worn Rocks of Scotland," by T. F. Jamieson, Esq., F.G.S. IV. "On the Glacial Origin of certain Lakes in Switzerland, Wales, Scotland, and elsewhere," by Prof. A. C. Ramsay, F.R.S., at 8 p.m.
Society of Arts, "On the Relative Merits of the different Systems of Working Metallic Mines and Collieries," by R. C. Salmon, Esq., F.G.S., at 8 p.m.

THUR.—*Royal Soc.*, at 8.30 p.m.
Antiquaries, at 8.30 p.m.
Royal Inst., "On Heat," by John Tyndall, Esq., at 3 p.m.
Linnean Soc., at 8 p.m.

FRI.—*Royal Inst.*, "On the Site of the Holy Sepulchre at Jerusalem," by James Fergusson, Esq., at 9 p.m.

SAT.—*Royal Inst.*, "The English Language—Conversation—Foreign Words—Slang—Public Reading—The Church Service—Speeches—The Bar—The Stage," at 3 p.m.

TO CORRESPONDENTS.

Received.—Capt. N., J. P. R., Paterfamilias (we consider Bradford's the best), J. P., R. G., H. J. W., Beaugard, W. P. H., Admiral P., J. P., D. J. H., W. W., Prof. R., M. P., C. and Co.

◆

Glasgow, 10th February, 1862.

Mr. Macquorn Rankine begs leave to send the Editor of the MECHANICS' MAGAZINE the annexed correction of two errata:—7th February, 1862, at page 78, column 2, line 10 from bottom, *for* "neutral attraction" *read* "mutual attraction;" page 79, column 1, line 11 from bottom, *for* "neutral attraction" *read* "mutual attraction."

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

THE PROJECTED CHANNEL RAILWAY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Some few weeks since you gave a detailed account of Mr. Chambers' plan for uniting England and France by a railway under the Channel, and since then you have inserted several letters on the question. I see that the scheme is advertised, agitated, and lectured on, and I suppose we shall soon see a company started for carrying it into effect. I see that a Mr. Henry Cook has been delivering a lecture on the subject in Whitehaven. As I believe the scheme to be altogether impracticable and likely to end in disappointment and loss, I beg to offer, through your Journal, two or three observations on its commercial aspects. According to the calculation of Mr. Chambers, the tube which he proposes to lay down would cost £12,000,000. Did no communication exist between England and France that would be comparatively a very small sum to be expended in making one. But as steam vessels are going and coming continually, and as the fare across the Channel is a very small one and the passage generally a very quick one, I think there will be considerable difficulty in raising the sum for such a purpose. A railway under the sea would not be so valuable a property as a railway on the land, as it would be more liable to accident and more difficult of repair: besides it would at any moment be subject to sudden destruction. Should a fracture take place in the tube, or should an accident occur to let in the surrounding water, the whole £12,000,000 worth of property, if not annihilated, would be rendered almost worthless. It is not, therefore, very likely that capital can be obtained for so precarious an enterprise.

Supposing there were no engineering difficulties but what might by ordinary energy and skill be overcome; supposing that the money could be raised, and the tube principle carried out, it is not certain that passengers would avail themselves of this mode of sub-ocean transit. The great majority of passengers go from England to France, and *vice versa*, during the summer months, when the sea is generally calm, and the passage rapid and certain. Who would not prefer a passage over the sparkling waves, in the pure air, to going through a dark, or artificially-lit-up hole, where the air must of necessity, be impure, the aspect dreary, and the mental sensations not the most elastic. I am a very poor seaman, and generally manage when I cross the Channel to part company with my last meal, but I would a thousand times rather undergo the temporary inconvenience of an hour's sickness, than I would go through a tunnel twenty miles long, breathing mephitic vapours, and realizing sensations as if I were going to Pandemonium. To go through Box tunnel is bad enough, when you are conscious that you are surrounded by the solid earth, and when there is no fear of an inundation; but to pass through a tunnel ten times as long, with the sea only separated from you by an iron tube, which at any moment may spring a leak, is not a very delicious journey to contemplate. I would therefore advise Mr. Chambers, Mr. Cook, and others, who appear to be expending some considerable ability in the agitation of this question, to turn their attention to something more practicable and reproductive.

Yours, &c.,

LEONARD FOSTER.

London, February 13, 1862.

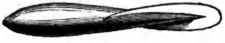
PROJECTILES.

SIR,—For a long time past the subject of projectiles has occupied a prominent place in the columns of your valuable journal, and also in the attention of the public, and the many discussions of practical and scientific men upon the subject, have done much to elucidate the laws which govern their flight. From the numerous treatises that have been written upon rifled cannon, small arms, and projectiles generally, it would appear that the limit of improvement is yet very far from having been attained. If you will permit me a small space in your journal, I will take advantage of it to throw out some suggestions, which may possibly prove of value to those of your readers interested in the subject.

Experience has abundantly proved the immense advantages gained by the substitution of elongated for spherical projectiles, as regards range, penetration, and accuracy of flight. These appear to result chiefly from the comparatively small resistance offered by the atmosphere to the flight of elongated projectiles; the column of air displaced by the passage of a conical shot being so much less than that displaced by a spherical shot of equal weight. Their initial velocities being the same, the former retains its momentum for a much greater time, thereby attaining much greater range. To attain this increased range, it is necessary that the elongated shot fly point foremost, to ensure which, *rifling* has so far been the only means found available, which by giving the shot a spinning motion round its long axis, preserves it in the position in which it leaves the gun, and neutralizes the various intrinsic forces which tend to give it an irregular flight.

In forcing the shot along the grooves of the rifle a great proportion of the propelling force of the powder is expended, and the initial velocity of the projectile most seriously diminished, often to the extent of 50 per cent., yet with all this loss the immense superiority of the elongated rifle bolt over the spherical shot fired from a smooth bore, is unquestionable; and this appears due partly to its spinning motion round its longitudinal axis, but principally to the smaller resistance to its passage through the atmosphere. If these peculiarities could be imparted to a shot fired from a smooth bore gun, it ought, from its greater initial velocity, to exceed as much in range and efficiency the rifled bolt of to-day, as that bolt does the spherical shot of days gone by. This, in my opinion, may be easily accomplished.

It has often been practically demonstrated, that a solid body meets with less resistance to its passage through a yielding fluid, if made in the form of a double cone, than in any other. Upon this principle then should projectiles be constructed, the "run" being greatly prolonged, as we see it in fishes and clipper ships.



A projectile of this form, having its centre of gravity thrown well forward, would have very little tendency to an irregular flight; it would present the least possible surface to the retarding force of the atmosphere, and would leave little or no vacuum behind it, an important item in the resistance experienced by cylindrical projectiles. Let this bolt be furnished with two or more "fins," set diagonally to its axis on its after extremity, it will then fly through the air with a spinning motion which will effectually correct any irregular tendency. Of course with suitable machinery these projectiles could be punched out complete from the solid metal as is now done with the Enfield bullet, the fins being merely thin ridges on the body of the bolt, terminating in a sort of rounded tail, which would aid in steadying the flight of the projectile.

By suitable expanding wads, applied *round* the shot, behind its extreme diameter, so constructed as to break or fall off on its leaving the gun, windage may be effectually prevented, and the shot sufficiently retarded to give time for the complete combustion of the powder.

Of course such a shot could be used most efficiently with a breech-loader, but with care in ramming down, it may be fired from any smooth bore gun.

How far the same principle may be applied to projectiles from heavy ordnance, I leave it to men of more practical experience to determine; but one thing is certain, that by the adoption of this bullet, and the consequent return to the smooth bore, the original cost, and the subsequent wear and tear of small arms, would be very materially diminished, and their comparative simplicity, both in manufacture and use, would at once give them a great advantage over the beautiful but delicate rifles now so much in vogue.

W. P.

◆

MINERS' HAVENS OF REFUGE.

Sir,—Your able articles urging the necessity of immediate measures being taken to avert the recurrence of such accidents as that which has just happened at Hartley, must impress on colliery proprietors the necessity and propriety of having two shafts, and also the desirableness of having a communication or staple between the different seams of coal. There is *another* safety-valve that might save the lives of miners, if the wooden brattice should be destroyed by fire or otherwise, and as it has not yet, to my knowledge, been noticed, permit me to describe it.—Bi-section of a shaft by a brattice generally produces sufficient ventilation in the whole of a colliery to enable miners to do their work in any part, but as soon as a brattice is disarranged the upward current of gas and downward passage of air cease, and what may have disturbed the brattice has probably interfered with the arrangements made for miners' leaving the pit. Inexpressible relief would be conferred to the minds of all engaged in underground workings, to be aware that on such fearful emergencies they could all resort for safety, and wait for relief, at some particular and selected part in each seam set aside for that purpose, and which could be easily ventilated perfectly distinct and *independent* of the mode adopted for the remainder of the colliery—the same as is done daily in ventilating parcular rooms in buildings.

The cost of these "havens of refuge" to miners would be inconsiderable, as by embedding either the brick or wooden casings of shafts, a diaphragm or concentrical pipe, laid from the outer air to the selected spot in each seam (a mere extension of the brattice principle) it would be accomplished. At each place appointed for the men to congregate it may be desirable to have the power to close the pipes where the miners in other seams have not been working.

I am, Sir, yours truly,
George Walcott, C.E.

Feb. 10th, 1862.

◆

STEAM HAMMERS.

Kent Iron Works, Bridge Street, Greenwich. S.E.
February 10, 1862.

Sir,—Having observed in your paper of last week that Mr. W. Hobson, of Ellesmere road, Sheffield has patented a steam hammer with a self-acting cylindrical equilibrium valve, I beg leave to state that Mr. Winton and I took out a patent dated 2nd April, 1861, No. 809, in which we claim as part of our improvements the cylindrical equilibrium valve to be either self-acting or worked by hand, and is precisely the same as the one patented by Mr. W. Hobson, and which I am at present manufacturing.

I am, yours truly,
Thomas William Cowan, Assoc. I.N.A.

Gossip.

◆

The report of the directors of the (old) Red Sea and India Telegraph Company, to be submitted at the meeting of the 17th February, recounts the arrangements which have been effected for the now completed transfer of the company's line and property to the new Telegraph to India Company. The directors conclude by congratulating the shareholders upon the "satisfactory termination of their protracted negotiations with the Government in an arrangement which, while it converts the guarantee into a government annuity of the like amount, admitting of no doubt or question, also affords a fair prospect of bringing to a successful result the great national undertaking of the establishment of telegraphic communication with India."

Captain Norton has written us a letter, in which he shows the necessity for the establishment of an Irish Volunteer National Guard. He accuses the Irish aristocracy with indifference towards the question, which in his opinion is vital.

A meeting of delegates representing collieries in Northumberland and Durham, was held in Newcastle-on-Tyne on Saturday last. After a petition praying that an enquiry would be made into the system of ventilating and working of mines with a view to the better protection of miners was passed, a discussion ensued on the present system of mine inspection, and the general feeling of the meeting seemed to be that under the system no inspector, with the number of pits under his charge, could visit one-half of them, and it was unanimously resolved that the present system was inadequate to its requirements, and that ten sub-inspectors, having charge of twenty collieries each, should be appointed by the Government.

Mr. George Shepperd, C.E., in a communication says :—The extraordinary discovery of rock oil in Canada is now creating very great interest in England. I am of opinion we have an abundant supply of this same article in England, and which can be obtained at a very cheap rate In the Shropshire iron district we have a rock known to the miners as the "stinking rock:" this rock yields a great deal of mineral tar; it is found in sinking to the coal and ironstone. I cannot just now inform you how thick it is, but I believe it is many feet; neither can I state the quantity of oil it would yield in the cubic yard—it has not been tested; but I have no doubt if an experiment were made it would be found a source of wealth equal to that of the mineral which lies below it. At Coalmoor a short distance from the Horsehay Works, some years ago some ironstone was got by open work, and this rock there is not above 10 or 15 feet below the surface. When a boy I have seen the oil run out of the bottom of the strata in the work below, and also large lumps of bitumen thrown out by the workmen. But the rock in the deeper mines will be found to contain large quantities of oil, if a proper experiment be made and the subject thoroughly investigated; if so, the quantity of this mineral is inexhaustible.

A trial of the engines and machinery of the frigate Galatea, took place outside Plymouth sound on Saturday last. The trial was considered quite satisfactory. The ship was built at Woolwich, is 3,227 tons, 280-ft. long and 49-ft. broad. The draught forward is 20-ft. 9-in. and aft 21-ft. 9-in. She is fitted with a pair of trunk engines, of 800-horse power, by Messrs. Penn and Co., and made six runs at the measured mile with an average of a fraction over 13 knots; revolutions, 57½; vacuum, 26 to 28; pressure of steam, 21lb.

E. B. Ward, Esq., of Detroit, has a new boat in process of construction, which will be propelled on a principle unlike anything ever seen on the Western waters. She will be what is called a beam-geared propeller, with an engine working athwart ships, every stroke of which will produce two and a half revolutions of the wheel. The new boat will have 187 feet keel, and 24 feet beam. The engine is being built at the Detroit Locomotive Works.

Dr. Letheby recommends the following method of detecting the presence of arsenic in wreaths and dresses:—"Put a drop of strong liquid ammonia (liquor ammoniæ, the druggist calls it) upon the green leaf, or dress, or paper, and if it turns blue, copper is present, and copper is rarely, if ever, present in these tissues and fabrics without arsenic being also present, the green compound being arsenite of copper. I have tested papers and dresses in this manner more than a hundred times, and have never failed to discover arsenic when the ammonia changes the green into blue. It is, therefore, indirectly, a very reliable test; and if every lady would carry with her, when she is shopping, a small phial of liquid ammonia, instead of the usual scent bottle, the mere touch of the wet stopper on the suspicious green would betray the arsenical poison, and settle the business immediately."

A short time since Londoners thought that they were about to have additional accommodation in the form of street tramways. One tramway was laid down from Bayswater to the Marble-arch, another along the Victoria-road, Pimlico, and a third in Lambeth. An aristocratic clique, joined by other interested parties, was too strong for the Marble-arch tramway, and it had to be taken up. Legal proceedings are pending over the Lambeth tramway, and we now see that at a recent meeting of the Board, held at Smith-street, Westminster, that it was unanimously resolved to serve Mr. Train with a final notice for the removal of the tramway there as "a dangerous nuisance." We fear that before long we shall not have a single street railway in London. We have ridden on those which have been laid down, and consider that the objections to them have been very much over-rated, and we suppose that much of the opposition against them has been manufactured by interested opponents—opponents who do not care about the convenience of the public, but their own vested interests.

The Albert Testimonial fund has now reached upwards of £30,000, and the probability is that it will be at least double that amount. The question now arises in what way should this munificent sum be appropriated. We hope it will not be expended in anything merely ornamental, however artistically executed. The late Prince was a pre-eminently practical man. His primary aim was to be useful, and we feel certain that had he been consulted on such an eventuality while living, he would have said "appropriate the sum so generously subscribed, in such a manner as to produce the largest amount of artistic, scientific, and educational good." We hope, therefore, those who have the disposal of the fund, will endeavour to make the Albert Memorial harmonise with the general character and purpose of the late Prince's life.

Manufacture of Iron.—A new system of smelting iron has recently been introduced by Mr. R. W. Sievier, F.R.S., and found to produce a metal superior to the iron manufactured by the ordinary process, being, in fact, ready at once to forge into razors. The principal feature of the invention is, that the air is drawn through the iron, instead of the blast being applied in the usual manner. For ourselves, we should be inclined to regard this as a change in the wrong direction.

Improved Hoisting Machinery.—At Minesota Mine, Lake Superior, it has recently been decided to substitute wire-rope for the old system of hoisting by chains, and the result has been an enormous economy—three times the quantity of mineral is drawn each time with the same amount of power; the wire-rope costs scarcely more than half that of chain, which is also much less durable; space in the shaft is economised by the use of iron cars and railway in the shaft, which improvement could not have been adopted had the use of heavy chain been continued. The cars are provided with wheels, and the load is dumped at the mouth of the pit without manual labour. The rope used is 3½ in. circumference, and is wound on a drum 7 ft. in diameter.

Steam Boiler Explosions Prevented.—A Correspondent of the *Mining Journal* says:—As any proposition for the prevention of loss of life unnecessarily is worthy of consideration, it may be interesting to know that Ericsson's caloric engine is now in use in 500 practical instances in the United States, the purposes to which it is applied being almost equally varied—this source of motion having been adopted for making matches, and for draining mines, for making hooped skirts, for picking hair, for irrigation, and for supplying villages with water, as well as for quartz crushing, grinding coffee, and numerous other purposes. The manufacturers of Ericsson's engine claim that by the use of hot-air engines steam-boiler explosions would be effectually prevented, and that there are few forms of labour employing steam in which this inexplosive and safe motor, Ericsson's caloric engine, might not be advantageously employed.

The Defences of New York.—General Arthur has remitted to the Legislature of the State of New York his report on the defences of New York Harbour. General Arthur states in this report that in case of sudden emergency recourse must be had to floating or fixed obstructions in the Channel. The Board of Engineers has been sitting since December, and it is confidently believed that lines of floating obstructions can be placed across the Narrows that will effectually prevent the passage of large ships, without injury to the channel. During the late threatening aspect of foreign relations, the Governor of New York purchased large quantities of timber, which is ready to be used to obstruct the channel in case of emergency. General Arthur likewise describes a plan whereby, in case of emergency, concealed obstructions could be sunk in two or three weeks in Fort Schuyler Channel and the channel leading to the lower bay. These obstructions would drive vessels into the immediate range of the guns on Sandy Hook. Plans for resisting a land invasion on Long Island shore are also discussed in General Arthur's report. He recommends the establishment of State foundries for the construction of arms and of iron mailed gunboats. State surveys will also be taken of all assailable points on the Lakes. Finally, General Arthur says that the State militia should be trained to the management of heavy guns.—*Morning Star*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 1849, 1851, 1867.

Boilers and their Furnaces, &c., 1883.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1813, 1874, 1889, 1890, 1891.

Ships and Boats, including their fittings, 1882, 1900.

Cultivation of the Soil, including agricultural and horticultural implements and machines, 1857, 1898.

Food and Beverages, including apparatus for preparing food for men and animals, 1858, 1886.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1814, 1852, 1859, 1861, 1862, 1865, 1894, 1903.

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1846, 1860, 1870, 1872, 1884, 1901.

Lighting, Heating, and Ventilating, 1817, 1912.

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1850, 1875, 1877, 1881, 1888, 1897, 1902.

Metals, including apparatus for their manufacture, 1848, 1854, 1863, 1868, 1869, 1900.

Chemistry and Photography, 1855, 1856, 1893.

Electrical Apparatus, *None.*

Warfare, 1853, 1871, 1873, 1880, 1887, 1904.

Letter-Press Printing, &c., *None.*

Miscellaneous, 1845, 1864, 1876, 1878, 1879, 1885, 1892, 1895, 1896, 1899.

1843. G. F. Griffin. *Improvements in the permanent way of railways.* Dated July 23, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1844. T. Gray. *An improved method of preparing flax from old materials for spinning and other purposes.* Dated July 23, 1861.

Here the patentee, 1, boils the old materials in a strong solution of soda ash, or other alkali, next cleanses the materials in hot or cold water, cuts them into suitably sized stripes or pieces, and runs them through a machine known as a "breaker," whereby the woof or wift is torn from the warp. The material is next passed through a tucker or revolving tenter hook machine, and finally passed through one or more carding machines as often as may be required. *Patent completed.*

1845. N. E. Dumesnil. *Improvements in lubricating materials.* Dated July 23, 1861.

This consists in the use of a mucilage composed of or prepared from vegetable or animal matter in the water usually employed with alkali in the treatment of the body of fatty matter. *Patent completed.*

1816. R. Thompson. *A machine for cutting wood.* Dated July 23, 1861.

This consists in an arrangement of machinery whereby revolving cutting tools for chasing, grooving, moulding, &c., can be moved (while in the operation of cutting, or otherwise), in any direction required by the workman, giving him complete command over the tool to follow any line of cut traced out, without in any way interfering with the revolving action of the cutter or other driving power. The principle consists in mounting the cutting tools in a carrier or traverse block, such block being free to travel along a beam, revolving motion being communicated to the cutter by a gut or band, actuated by a double grooved pulley revolving freely upon a shaft. *Patent completed.*

1847. J. H. Johnson. *Improvements in forges.* (A communication.) Dated July 23, 1861.

This relates to portable and other forges, whereby the blast may be heated during its passage through the nozzle or blow pipe. The patentee proposes to combine the fire back and the blow pipe in one, and to form a circuitous channel or an air passage inside the fire brick, which is in direct communication at one end with the bellows or blowing apparatus, and at the other with the nozzle or blow pipe. The contact of the flame and heated fuel with the brick plate heats the air as it passes along its circuitous channel, and, consequently the advantages of a hot blast are obtained, whilst the apparatus itself is of the simplest and most economical construction. *Patent completed.*

1848. F. Hirschfield. *Improvements in ornamenting or decorating articles of iron.* (A communication.) Dated July 23, 1861.

This relates to marquaterie to the ornamentation of articles composed of iron, and consists in the application of marqueterie of copper and other metals, of various kinds of woods, of shells, of tortoiseshell, mother of pearl, and other suitable substances, to all kinds of articles composed of iron. *Patent abandoned.*

1849. W. Clark. *Improvements in apparatus for the condensation of steam in marine engines, and in the particular application of parts thereof to the ship.* (A communication.) Dated July 23, 1861.

This relates to improvements in refrigerators used in cooling the injection water of marine engines; also in improved means of supplying sea water to such refrigerators by utilizing the motion of the vessel in which the apparatus is applied; also in an improved arrangement by which the water of condensation is reconducted automatically into the boiler. *Patent abandoned.*

1850. F. Hirschfield. *Improvements in locks and keys.* (A communication.) Dated July 24, 1861.

This relates to safety locks and keys, and consists, according to one arrangement, in the use of a key having no bit, but provided in lieu thereof with one or more circular projecting rings or collars of different diameters, formed upon the stem or shank near the end thereof, whilst the extreme end of the key is provided with a square or other suitably shaped projection intended to fit into a corresponding hole in a guard plate in the lock, and to turn the same partly round. The rings or collars are upon corresponding moveable plates or tumblers. *Patent abandoned.*

1851. T. Hughes. *An improved steam generator.* Dated July 24, 1861.

This invention comprises much detail, which we cannot with advantage produce here. *Patent completed.*

1852. F. Mills. *Certain Improvements in machinery for carding cotton and other fibrous materials.* Dated July 24, 1861.

This consists in bringing the set screws to the bottom of the brackets, so that the ends of the set screws shall project through the flange of the bend, where they are secured by lock nuts, thus preventing the possibility of wear on the threads of the screws, and always maintaining the parts in good working condition. *Patent abandoned.*

1853. J. Sidebottom. *Improvements in fire-arms and ordnance.* Dated July 24, 1861.

This relates to a former patent, dated 15th January, 1861, No. 109, and consists in the application of a break or breaks to the barrels of fire-arms and ordnance, for regulating or controlling the recoil, and the rotary motion imparted to the barrel during the recoil, by a curved scroll or other equivalent. These breaks may be applied by hand, or by the recoil of the barrel, or by both. When applied by hand, a friction clip applied to the barrel is tightened by a screw, or other equivalent; or the bearings supporting the barrel may be tightened. When the break is applied by the recoil, the barrel acts on a lever or other equivalent connected to the break, which is thus tightened. *Patent completed.*

1854. J. Badard. *Turning and planing metals, the tool advancing sideways, and cutting in an oblique position.* Dated July 21, 1861.

The object here is to use a lathe or plane, no matter how small a shaving or chip is to be removed from the object submitted to them, and thus to save time in proportion to the small portion of the material to be planed off. The inventor proposes to incline the tool so as to obtain the greatest dimension of shaving, and he finds that to obtain its thickness, the lateral advancement of the tool should be multiplied by its perpendicular height, and the lateral advancement equals twice one and a-half of the old system, and gives an economy of cent. per cent. *Patent abandoned.*

1855 H. Neville. *Improved apparatus for taking photographs.* Dated July 24, 1861.

This instrument is in shape similar to a common camera, about eighteen inches in length. At one end is attached a brass telescopic tube, forming what is termed "the coarse adjustment." Outside the last-mentioned tube is placed a larger tube, having a fine threaded screw or rack and pinion, forming the "fine adjustment." Attached to these tubes is a piece of metal or wood, dovetailed, into which slides a box containing the prepared plate, which rests upon silver pins, and is secured in its proper position by springs attached to a lid covering it, made of metal or wood. Inserted in the centre of this lid is a microscope for focussing the object to be copied, which, when once adjusted, enables the operator to take any number of photographs, without any further adjustment or alteration. *Patent abandoned.*

1856. W. E. Gedge. *Improvements in the preparation and clarification of the saccharine matters obtained from beet-root, sugar cane, indian millet, and other sacchariferous vegetables or plants.* (A communication.) Dated July 24, 1861.

This consists in the extraction of sugar without the use of bone black or animal charcoal, and the process is based upon the use of two products, the one alumina in jelly or viscous state, the other subacetate of lead. The first, from its affinity for the coloring matter; the second to precipitate the gummy matters. *Patent abandoned.*

1857. W. M. Cranston. *Improvements in grass-mowing machines.* (A communication.) Dated July 24, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1858. A. Wood. *Improvements in apparatus employed for fermenting purposes in brewing beer, as also for storing beer and for general purposes of fermentation.* Dated July 24, 1861.

The patentee claims, 1. The construction of fermenting tuns in which covers are employed, having attemperating metal vessels, with either plain or corrugated metal surfaces not in contact with the fermenting liquor, but which serve to attemperate the yeast, barm or fob after it has left the fermenting liquor, in combination with other attemperating metal vessels, with either plain or corrugated surfaces, and provided or not with partitions, which vessels are fixed upon the bottom of fermenting tuns, and through which cold or warm water is made to flow, substantially as described. 2. The attemperation of the yeast, fob, or barm, after it has left the fermenting liquor, by means of hollow metal covers, either fixed or floating, constructed substantially as described through which cold water is made to flow, and which covers do not act upon the fermenting liquor in the tun. 3. The use of fermenting tuns, constructed as described, for storing fermenting liquors after the process of fermentation has been completed. *Patent completed.*

1859. R. Threlfall. *Improvements in machinery or apparatus for spinning cotton or other fibrous material.* Dated July 24, 1861.

This relates to the self-acting mule, and consists in an improved mode of governing the copper faller while the yarn is being coiled on the spindles at the time the carriage has receded to the roller beam; and, also, in an improved mode of receding the carriage at any desired speed, according to the number of the yarn to be spun. *Patent completed.*

1860. A. J. D. Spitz. *Improvements in the drying of bricks and other articles manufactured of fire-clay or common clay, and in the construction of drying-rooms for such purposes.* Dated July 24, 1861.

Here a closed drying-room is constructed, provided with a ceiling having openings therein, closed by shutters, and having skylights. This room is fitted with benches constructed of flags, quarls, slates, &c., to receive the bricks or other articles to be dried, spaces being left between for the passage of barrows and workmen. In this drying-room is arranged a system of pipes, heated by preference by the waste steam from the steam-engine, as being more economical, but a separate boiler may be used if necessary. *Patent abandoned.*

1861. J. Platt and W. Richardson. *Improvements in machinery or apparatus, commonly called 'gins,' for cleaning cotton from seeds.* Dated July 24, 1861.

This consists in exposing the delivery rollers to the action of a current of air, whereby they are prevented from "lapping;" and the collection of the material from one or from a series of machines, is facilitated. The inventors use a fan which exausts air from a casing adapted to the said rollers, and this fan may be used in conjunction with one or more machines. *Patent abandoned.*

1862. H. Cook. *Improved apparatus for punching or marking the pattern cards used in weaving figured fabrics* Dated July 24, 1861.

This invention is not described apart from the drawing. *Patent completed.*

1863. W. Longmaid. *Improvements in the manufacture of iron.* Dated July 21, 1861.

Here either silver, copper, tin, or nickel, or compounds of some of these metals in comparatively minute quantities, are used in the manufacture of iron, and they are applied when the iron is in a state of fusion, when refining or puddling iron. *Patent completed.*

1864. F. D. Blyth. *Improvements in tools.* (A communication.) Dated July 25, 1861.

This consists in so forming the pointed screw or gimblet that cutters of various sizes can be fixed on the screwed part of the spindle of the gimblet, so as to leave the point and a portion of the screw projecting beyond the cutter, so that in boring a hole the screw will partly prepare the way for the cutter. *Patent abandoned.*

1865. B. Brown and R. Hacking. *Certain improvements in machinery or apparatus employed in spinning cotton, wool, silk, and other fibrous substances.* Dated July 25, 1861.

This relates to throstle frames, and consists in arranging the parts so that the regularity and certainty of the lift of the copping rail may be affected to the utmost by simply having the racks of teeth made separate and independent of their carrying or supporting bar or rail, being attached thereto by a screw bolt capable of sliding in a groove or slot in such bar or rail, and adjusted by a horizontal screw and not at the outer ends, so that by the slightest turn of which said screws, the racks may operate upon the copping motions, and regulate the lift of the copping rail as is required. *Patent completed.*

1867. D. Spiak. *Improvements in steam-engines.* Dated July 25, 1861.

The object here is the regulating of the pressure of steam on the pistons of steam-engines when it is cut off from the boiler, and this object is effected by employing a separate vessel or vessels in connection with the cylinder and steam-pipe of the boiler, the pipe having a valve or valves to cut off the steam in the separate vessel or vessels from the boiler at the beginning of each stroke of the piston. At each end of the separate vessel is also a regulating valve for admitting the steam gradually to press alternately on either side of the piston. *Patent abandoned.*

1868. R. Kelly and J. Shakespeare. *New or improved machinery to be used in the manufacture of tin plates and terne plates, and iron plates coated with lead.* Dated July 25, 1861.

This consists essentially in the use of certain suitably-arranged rollers and brushes for the purpose of, 1, scouring or cleaning the plates prior to their immersion in the melted tin; and 2, for polishing the sheets of metal after leaving the bath of metal. *Patent abandoned.*

1869. E. Harffely. *Improvements in extracting copper from its ores.* Dated July 25, 1861.

These improvements relate, 1, to the extraction of copper from its ores by an inexpensive menstruum, and this part of the invention is applicable chiefly to those ores which have been used in making sulphuric acid, such ores containing comparatively but small quantity of the metal. For this purpose the patentee uses the refuse liquid discharged from chlorine generators. 2. They relate to the precipitation or separation of copper from its solution, for which purpose he uses the refuse known in alkali works as "vat waste," which material, being at present of no commercial value, affords the means of effecting a great saving in the required operation. *Patent completed.*

1870. J. Simmons. *Improvements in the construction of buildings, to enable them to withstand the destructive action of fire.* Dated July 25, 1861.

This consists essentially in making the cast-iron girders and columns used in supporting the various floors hollow, and in connecting them together in such a manner as to form a clear water-course throughout the whole series. *Patent abandoned.*

1871. C. Robertson. *Improvements in sights for fire-arms.* Dated July 25, 1861.

Under one modification of this invention, when applied to a single barrelled piece, a moveable sight bar is placed on the top of the barrel itself. This sight bar consists of a bar or rib or strap of steel, or other suitable metal or materials, which, on the upper side, is a level plain, nearly corresponding in appearance with the centre bar or rib at present used in double-barrelled rifles on which the sights are placed, with this exception, that there are no raised back sights, as these are, in the present invention, superseded by a movement of the right bar to be afterwards explained. On the under side this sight bar is formed so as to fit and rest on the upper portions of the barrel; or it may be fixed upon a saddle piece of the same metal, or some other suitable metal or material, formed so as to fit and rest on the barrel. In length this sight bar is made to extend from the muzzle of the piece to the breech or beyond it. It is attached to the barrel at the muzzle, and by means of a hinge at the point of attachment it is capable of being raised up from the barrel, so that the elevation at the breech end, suitable for shooting at long distances, may be obtained by a vertical movement of the whole bar, or of the bar and saddle piece from the hinged point. This movement of the sight bar is effected by means of a screw actuated from the side of the slab or from beneath it. *Patent completed.*

1872. R. R. Swann. *A fire preventive ceiling and apparatus for the extinction of fire in warehouses, stores, depôts, and buildings.* Dated July 26, 1861.

This consists in providing each room in the building with a double or single ceiling, constructed of metal, or other suitable material, the lower ceiling being perforated with numerous small holes of such number and size as to flood every portion of such room when the water is turned on. Between the double ceiling are inserted a number of perforated pipes or spreaders, of any length, form or size, as may be found necessary for the perfect distribution of the water injected through a suitable main pipe connected by stop cocks or valves with a tank to be kept constantly full of water on the top of, or contiguous to, such warehouse, store &c., furnished with this apparatus. *Patent abandoned.*

1873. J. F. Bouane. *Certain improvements in the construction, armament, and equipment of batteries floating or otherwise, for war purposes.* Dated July 26, 1861.

The patentee claims, 1. The use of three or more layers, strata, or thicknesses of plates, or plates and bars, in the construction of the defensive parts of the battery, in the manner described; also the mode of protecting the decks and crew by continuing the sides so built in an arch vaulting over head. 2. The use of india rubber, commonly so called, or other elastic gum, placed in thin sheets between the surfaces and edges of the plates and timber, or between the plates and timber, or other material used in building an iron plate battery; also the use of asphalte or asphalte mixed with lime and saw-dust, as a waterproof bed in which iron armour plates may be laid. 3. The mode of securing armour plates to the defensive parts of batteries by means of bolts welded to any plates which may be required to be bolted on; and the mode of securing large plates as described. 4. The gun carriage or traversing platform as described, and the circular concave porthole with the ball pivot on the platform for gun to work therein. 5. The mode of laying guns by means of guide rods with a sight hole in the face of the battery, distinct from the port hole, as described. 6. The application of elastic breechings and other ropes in the working of guns as described. 7. The mode described of converting a wooden ship into an iron plated battery by the use of a series of diagonal plates or bars of iron between the timbers and the armour plates with india rubber sheathing or caulking. *Patent completed.*

1874. F. Johnson, and B. Hockin. *Improvements in securing or fastening nuts for railway fish plates and other purposes.* Dated July 26, 1861.

This invention consists in dividing the front of a screwed bolt or pin longitudinally, to an extent sufficient to enable a thin metal wedge to be inserted therein, for the purpose of expanding the point of the bolt after it is in position and the nut has been screwed on. The wedge piece should be of a width not exceeding the diameter of the bolt at the bottom of the threads, at the part where the slot is formed, and the patentees prefer to form a slot or long hole in the upper part or portion of it, to admit of a split pin being passed through it. They also drill a hole through the point of the screw across its diameter, for the purpose of receiving a split pin or cotter to hold the wedge in its proper position. When the nut has been screwed on into the required position the wedge is inserted into the point of the bolt, and the cross split pin is then inserted into the hole and through the wedge which is thereby secured. *Patent completed.*

1875. F. N. Truzel. *A method of fastening shoes, stays, gloves, and other wearing apparel.* Dated July 26, 1861.

This consists in a new description of eyelet holes made by preference, of metal and composed of two distinct parts, which are the eyelet hole proper, and a tail or shank for supporting or fixing the eyelet hole; this part may be made distinct, and of a different material from the eyelet hole. A lace is passed through the eyelet holes, and the two extremities are united by a ligature, or by a kind of pincer, which holds the two ends of the lace, and which is opened to set them free. *Patent completed.*

1876. E. Sang. *An apparatus for indicating the direction of objects and measuring angles.* Dated July 26, 1861.

This consists in the use of a piece of glass or other transparent substance so constructed as that, when a certain straight line fixed in regard to the piece of glass is directed to any object, and the eye brought near to its edge so as to look partly at the object and partly into the glass, an image of the object may be seen as well as the object itself, the coincidence of the image with the object being a proof that the said straight line is accordingly pointed to that object. *Patent completed.*

1877. W. Wigfall. *Improvements in the manufacture of brushes and brooms.* Dated July 26, 1861.

This invention relates to an improved mode of securing the bristles, bass, or fibres, into the head, stock, or handle of a brush or broom, and consists in inserting a peg amongst the bristles, bass, or fibre, and into the hole which receives them, so as to act as a tightening wedge thereon, and thereby firmly secure them in their place. *Patent completed.*

1878. W. E. Gedge. *An improved weighing machine.* (A communication.) Dated July 27, 1861.

This consists in a method of applying the poise of the physical bodies known as the extension of fluids. *Patent abandoned.*

1879. J. H. Johnson. *Improvements in sewing machines.* (A communication.) Dated July 27, 1861.

The patentee claims, firstly, the general constructions, arrangements, and combinations of parts of sewing machines as described. Secondly, the combination in a sewing machine of a supporting table and an eye-pointed piercing needle, with a lower needle, or looping instrument having motions in six directions, in the manner and for the purpose described. Thirdly, the mode of imparting motion in six directions to a lower needle or looping instrument in sewing machines, by means of an inclined crank pin, substantially as described. Fourthly, the combination of a tension apparatus, a check spring, and nippers, arranged and combined substantially in the manner and for the purpose described. And, lastly, the peculiar "take up" apparatus, consisting of two stationary eyes with an edge piece and reciprocating fork, operating substantially in the manner and for the purpose described. *Patent completed.*

1880. R. E. Garrood. *Improvements in mitre boxes and shooting boards.* Dated July 27, 1861.

This invention has for its object improvements in mitring mouldings for picture frames, and such like things, and for this purpose the patentee applies to the ordinary mitre box or shooting board (as used by joiners) a stationary screw, to which power is applied by the thumb and finger, or any other suitable means, combined with a nut moveable in or between guides, which nut has on its sides a claw or projection, so as to press on to the moulding when screwed down, and hold it fast whilst being planed or reduced to a level and proper length. On the inside at the lower end of the mitre box is a moveable slide or gauge which can be fixed in its place by a set screw, so that two or more lengths of moulding can be ganged to the same length. *Patent completed.*

1881. J. B. Hebbert. *Improvements in fire guards.* Dated July 27, 1861.

For the purposes of this invention the patentee employs a guard or screen of flexible wire work, which is attached at its upper end to a roller, on which, when out of use, it can be rolled up; the roller is enclosed in a suitable case, having a handle attached to it, and the roller is furnished with a spring, causing it, when it is left free to do so, to wind up around itself the guard or screen of flexible wire work. To the lower end of the wire work a bar is connected, which serves to prevent the end of the wire work being lost within the case when the spring winds it up. When the fire guard so constructed is required for use, the handle on the case is hung upon a suitable hook on the front of the stove, immediately over the fire (or the guard is otherwise secured in this position), and then by drawing down the bar at its end the flexible wire work is unwound from its rollers, so as to descend in front of the fire, and it is there secured by passing the bar under a hook or projection in the fender or otherwise conveniently placed. *Patent completed.*

1882. W. H. Harfield. *Improvements in constructing and propelling ships and vessels.* Dated July 27, 1861.

For the purposes of this invention, in order to use a padddle wheel in the centre line of a ship or vessel, and to work in a close case in water, the surface of which is at a lower level than the surface of that in which the vessel floats, the bottom of the ship or vessel is to be built with a hollow groove or inverted trough from end to end thereof. The sides of such inverted trough or groove are preferred to be upright and parallel, and of a depth somewhat less than to the water level in the paddle wheel case. This inverted trough is constructed with suitable metal framing, and plated with metal plates, in like manner to that in which iron ships or vessels are now built. On each side of this inverted trough, a groove or keel may be formed. Intermediate of the length of this inverted trough or groove, is constructed an air and water-tight chamber, of suitable dimensions for receiving the paddle wheel. This air-tight chamber is open at bottom and closed at top, there being, however, a man hole, capable of being closed air-tight, at the top, in order to admit of persons getting into the paddle wheel case, or chamber; this paddle wheel chamber or case is constructed with metal framing, and plated over in like manner to that practised in building iron ships or vessels. By thus constructing a ship or vessel with a hollow groove or inverted trough of metal along the bottom, and a chamber for the paddle wheel of metal, great strength in the construction of a ship or vessel may be obtained. The paddle wheel shaft turns in bearings supported at the sides of the chamber or case, and the shaft or axis passes through stuffing boxes into the interior of the ship or vessel, in order that the air in the chamber may not escape, and that, when the water is allowed to rise in the paddle wheel case to a level corresponding with the line of floatation of the ship or vessel, the water may not pass into the ship or vessel, as in many cases the paddle shaft will be below the level of the exterior water. *Patent completed.*

1883. E. P. Colquhoun and J. R. Thomson. *Improvements in fire-bars for furnace grates.* Dated July 27, 1861.

The patentees claim making the front bearers of each range of fire bars movable, and connecting them by a rod passing beneath the fire bars, in the manner and for the purposes described. *Patent completed.*

1884. C. E. Amos. *Improved machinery for dressing slates.* Dated July 27, 1861.

This invention relates to a novel arrangement of machinery whereby roofing slates may be cut, trimmed, or dressed to the different sizes used for building purposes. The machine consists of a rectangular frame, which may, if necessary, be mounted on wheels, for the convenience of transporting or removing the machine from one locality to another. This frame is provided with a fixed knife, and also suitable bearings for a lever or "sword arm," which carries a movable knife. The "sword arm," or lever, is suspended by a spring or springs, so that, when in a normal position, the movable cutting edge is raised above the lower knife edge, and the two edges resemble a pair of open "shears," and act in the same manner. A treadle-frame is attached by means of a link to a lever which is upon the same spindle as the "sword arm," and the knife edges are brought together by the pressure of the foot of the workman; or, if desired, the machine may be worked by mechanical power, by applying power to the treadle lever; or the treadle lever may be dispensed with, and the power may be applied direct to the "sword arm." The spindle of the "sword arm" is made adjustable to compensate for wear in the cutting edge, and other working parts, and a gauge plate with suitable marks or points, corresponding to the different recognized sizes of roofing slates, is placed on the framework so that the rough slate, may be laid in their proper places and adjusted with facility. *Patent completed.*

1885. J. Robertson. *Improved apparatus for the treatment of the human body, or any part thereof, when afflicted by pain.* Dated July 27, 1861.

This apparatus consists of a water-tight vessel, made of tin or other suitable material, inside of which is placed another water-tight vessel of similar construction. The inner vessel is so formed and placed that there is a vacant space between it and the outer vessel at the bottom and sides, and the space at the top between the two vessels is covered in with some water-tight material. The mode of using this apparatus is to place such part of the person as is afflicted in the inner vessel, and to fill the space between the two vessels with hot water, by means of an orifice to be left for that purpose, which may be furnishdd with a funnel, as a convenient means of introducing the water. It is desirable to have a flap turning on a hinge on each side at the top of the inner vessel, which, when fitted with flannel or other suitable material, may, after the leg, for example, has been placed inside the inner vessel, be turned down against the limb with the view of preventing the escape of heat from the limb under treatment. *Patent completed.*

1886. Sir J. Hare. *Improvements in the manufacture of sugar.* Dated July 27, 1861.

This invention consists in manufacturing and breaking sugar in blocks, either square, round, oval, hexagonal, octagonal, or other regular shape; and of various sizes, and of uniform weight, according to the purpose for which they are intended, by casting them in moulds of metal, glass, china, or other suitable material, when they may be colored to any desired tint, as fancy may suggest. The object is to produce sugar in suitably given sized blocks, of uniform weight, more particularly adapted for domestic purposes. *Patent abandoned.*

1887. G. Sturrock. *Improvements in the construction of breech-loading firearms.* Dated July 29, 1861.

This invention consists in the construction of breech-loading firearms whereby the chamber which receives the charge is made to open out clear of the barrel by a lever which, when pressed upwards by the hand, raises a slotted wedge plate from between the face of the fore end or false breech and the back end of the chamber, and allows the chamber to slide backwards upon a longitudinal bolt hinge lying parallel with the axis of the gun. This motion clears the fore end of the chamber (which is cylindrical, and slightly coned) from the back end of the barrel (which is recessed and correspondingly coned), and thus admits of the chamber being folded out to receive the charge. The gun can be constructed so as to receive the ammunition at the fore end of the chamber, or to receive the cartridge (known as the Lefaulcheux) at its back end, in which latter case the chamber is hollow throughout, the back end being closed for firing by a plate of metal hinged upon the back end of the chamber. When the chamber is opened out clear of the barrel, this plate is folded back to enable the Lefaulcheux cartridge to be introduced at the rear or back end of the chamber. One lever is used for the whole of the movements required in loading, and with the ordinary cartridge the gun may be loaded at the muzzle if desired. *Patent completed.*

1888. F. TOLHAUSEN. *Improvements in comforters, neckties, cravats, and the like articles of garment for the neck and chest.* (A communication.) Dated July 29, 1861.

These improved comforters are made up of a comparatively narrow band of silk, cloth, or other suitable material, which band surrounds the neck or throat, and its two ends, joining at the front part of the throat, widen out into two wide scarf-like flaps or skirts, with which the wearer covers his chest, by either crossing the said flaps or laying them parallel (more or less overflapping) on his bosom. At the point where the narrow throat-band merges into the wide flaps, the comforter is united by means of a stud, or a button, or a breast pin, or a clasp, or any other suitable locking device. The visible or outer side of this comforter is ornamented in any suitable style or pattern, such as trimmings of artificial or real fur set along the edges. *Patent abandoned.*

1889. W. BUSBY and D. BUSBY. *Improvements in street or road rails, for omnibuses and other vehicles.* Dated July 29, 1861.

In carrying out this invention, the inventors form the top of the rails, with slightly raised guiding feathers on either side of the bearing surface, and shape the said bearing surfaces to the form and breadth of tyre best adapted for the streets or roads where the rails are laid down, and which may be concave, convex, angular, or other form, but more generally, and by preference, a perfect plane. The bottom or under side, when resting on transverse sleepers, is perfectly smooth, but, when longitudinal sleepers are used, have tapering flanges on either side to fit over the same. Running angularly from the vertical sides between the guiding feathers and flanges, or feathers and under side, are small counter sunk holes or apertures, through which and into the sleepers are passed the fastening bolts or spikes. *Patent abandoned.*

1890. R. RILEY. *Improvements in fusee signals, and in means or apparatus for applying or placing them and fog signals on the rails of railways from the van of a train in motion.* Dated July 29, 1861.

These fusee signals consist of cotton or other combustible substance saturated in spirits of wine, turpentine, naptha, or other inflammable spirits, and are attached to the ordinary fog signals. The means or apparatus for applying them to the rails consists of a portable tube placed or passed through an opening or hole in the floor behind the wheels of the van of a train, which tube extends nearly to the surface of the rails. The fog signal is attached to a rod by a leaden lip or tongue, and the fusee ignited. Then the rod with the signal is passed down the tube, and the signal smartly pressed on to the rail by the guard or attendant, the spring clips holding it thereon as usual, and the rod is separated therefrom by the movement of the van. *Patent completed.*

1891. W. MELROSE. *Improvements in the construction of railway wheels.* Dated July 29, 1861.

This invention relates to an improved method of connecting the tires of railway wheels to the spokes and nave thereof, and consists in forming the tire in a novel and improved manner for that purpose, that is to say:—Instead of simply rolling a bar with a flange at one side thereof only, as heretofore practised, the patentee proposes to form a bar with two flanges, produced by passing the bar whilst hot between rollers, so shaped as to make two longitudinal grooves in the bar opposite to each other, bounded at the outside by a flange, so that these parts of the bar in cross-section would be of the shape of the letter T, or the entire bar would be of the shape of the letter H, one flange being shaped in the ordinary way to roll on the rails of a line of railway, the other flange being employed to connect the spokes and nave of the wheel to the rim or tire as follows:—The inventor takes a bar of the above-mentioned shape, and joins the two ends in the usual way for forming the tire of the wheel. He then removes, by means of a slotting machine, certain portions of the inner flange to receive the spokes of the wheel, say eight or more in number, and he proceeds to connect the spokes and nave to the tire as follows:—He forms the spokes and nave aforesaid in two parts, or in other words, he forms or shapes two similar pieces of wrought iron, each with eight or more spokes connected together by a ring or flange, and a nave or boss projecting only on one side of the arms, the other side or surface being perfectly flat; the flange on the spokes fits into the grooves in the tire, the spokes fitting into the recessed parts of the inner flange of the said tire, so that one half set of spokes and nave are inserted into the tire at one side thereof, and the other half set of spokes and nave are inserted into the opposite side of the tire, and the two halves connected together by screws or rivets, passed either through the spokes or nave, or both. By thus constructing railway wheels, the tire is securely connected to the spokes, without the aid of screws or rivets for that purpose. *Patent completed.*

1892. C. C. J. GUFFROY. *Improvements in preparing medicinal substances and compounds from the livers of cod and other salt water fish.* Dated July 29, 1861.

This invention refers to a previous patent, dated July 20, 1860 (No. 1761), and consists in a method of preparing new medicinal substances and compounds from the watery liquids obtained in or remaining after the extraction of oil from the liver of cod and other salt water fish. *Patent completed.*

1893. W. L. SCOTT. *Improvements in preparing red, purple, and certain other dyes.* Dated July 29, 1861.

The main feature here consists in the use of binitronaphthaline, as a basis for red and certain other dyes. *Patent completed.*

1894. E. H. JOYNSON. *Improved machinery or apparatus for disentegrating, crushing, or drawing out vegetable fibres.* Dated July 29. 1861.

The improved machine consists as a travelling endless table, composed of metal plates joined together in the form of an endless chain, which passes round two octagonal or prism rollers, to which motion is communicated from the prime mover by any convenient arrangement of gearing. A stationary table on which the vegetable fibre to be operated on is placed by the attendant, is situated at one end of the machine, and another table, inclined board, or suitable receptacle, to receive the disintegrated fibres after they have passed through the machine, is situated at the other end. *Patent completed.*

1895. P. HALL. *A simultaneous manifold drilling machine.* Dated July 30, 1861.

The object here is the construction of a machine by which a large number of holes can be drilled at one time, and is capable of being readily adjusted, so as to perform a great diversity of work. *Patent abandoned.*

1896. T. SAUNDERSON. *A pasteboard, millboard, and cardboard medal for advertising purposes, in lieu of handbills.* Dated July 30, 1861.

This consists in an imitation of medals in pasteboard, millboard, cardboard, and papier mache, the sizes of the coinage of Great Britain and Ireland, or any other country and printed in gold, silver, and copper bronzes, &c., with and without any device inscription, medallion, or design printed, embossed, engine-turned, or stamped thereon, for any advertising trade or secular purpose. *Patent abandoned.*

1897. T. BRADFORD. *Improvements in washing, churning, wringing, and mangling machines.* Dated July 30, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1898. W. H. ASH. *Improvements in reaping and mowing machines.* (A communication.) Dated July 30, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1899. T. S. CRESSY. *Improvements in machinery used in the manufacture of casks.* Dated July 30, 1861.

This relates to machinery for shaping the ends of the staves of casks to prepare them for receiving the head, and consists in the use of a rotatory cutter or cutters suitably formed to make the groove in the staves for receiving the outer edge of the head, and also to bevil the ends of the staves, and to cut away the middle portion of the staves first above the groove so as to make the interior of the cask at that point circular. *Patent completed.*

1900. A. PARKES. *Improvements in the manufacture of sheathing metals for ships and vessels.* Dated July 30, 1861.

This consists in combining a very small percentage of tin or aluminium with sheathing metal composed of copper and zinc. *Patent abandoned.*

1901. M. ALLEN. *Improvements in the construction of buildings and in materials and machinery to be employed therein and therefor.* Dated July 20, 1861.

The chief feature in this invention consists in the staircases being rendered fire proof by insulating them from every material portion of the building. The stairs are arranged in a semicircular or other recess in the outer wall of the building, extending from its foundation to the roof, there being no openings on its inner side. *Patent abandoned.*

1902. J. M. HART. *Improvements in the arrangement or construction of parts of locks or fastenings.* Dated July 30, 1861.

This invention comprises much detail which we cannot give space to here. *Patent completed.*

1903. H. POTTER. *Improvements in treating or preparing textile materials and fabrics.* Dated July 31, 1861.

Here the object is to increase the density or substance of cotton and other fibrous materials and fabrics. The inventor effects this by subjecting the fibrous materials or fabrics to the action of a solution of rosin, or the product left after distilling the volatile oil from the different species of turpentine. The rosin is precipitated into the fibrous materials or fabrics by sulphuric or other acid, or by acid gases or vapours. *Patent abandoned.*

1904. H. J. HOLLAND and W. PAYTON. *Improvements in breech-loading fire-arms.* Dated July 31, 1861.

The patentees claim the application and use in breech loading fire-arms of a slotted tube and collar, screwed externally on the rear end of the barrel, having a plunger provided with a longitudinal rib or protection sliding therein, in combination with a slot or recess formed in the screwed breech-end of the barrel, as described. Also making the front end of the plunger above referred to loose from the body of the plunger, so as to admit of the plunger being partially rotated, while the loose end thereof remains stationary inside the breech of the barrel, as described. Also the application and use of a vertical cam or lever, situate between the pivot or working centre of the barrels and their breech ends, in combination with front and rear protections fitted to or forged upon the barrels as described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Sept. 30, 1861.

2438. E. Reoche, Rue d'Enghien, Paris, chemist. A new medicinal preparation, applicable internally for rheumatism and other disorders.

Dated Nov. 22, 1861.

2935. T. W. Davenport and S. Cole, Balsall Heath, Worcester, manufacturers. Improved compositions to be used in making buttons, beads, miniature and picture frames, and other articles susceptible of being moulded in a plastic material.

Dated Nov. 23, 1861.

2942. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. An improved apparatus for the multiplication of motive power. (A communication.)

Dated Jan. 4, 1862.

34. J. Howden, Glasgow, engineer. Improvements in steam engines and boilers.

Dated Jan. 9, 1862.

59. C. W. Siemens, 3 Great George-street. Improvements in the means and apparatus employed for insulating and protecting telegraph conducting wires, and in apparatus for working the same. (Partly a communication.)

68. B. Thompson, Birmingham, merchant. Improvements in ordnance and fire-arms, and in projectiles to be used therewith. (A Communication.)

Dated Jan. 10, 1862.

74. F. Moores, Warrington, Lancaster, iron merchant. An improved method of obtaining motive power by means of water wheels.

Dated Jan. 11, 1862.

86. W. Wilkinson, 20 Charlotte-street, Fitzroy-square, engineer. Improvements in ornamenting and decorating metals, glass, porcelain, parchment and other skins, and in the materials and ingredients employed therefor, also in protecting silver and gold on said materials, and on surfaces or plates of glass or metal, or plates of glass and metal combined, applicable to works of art, furniture, jewellery, and other articles of a useful and ornamental character.

Dated Jan. 14, 1862.

102. E. W. Hughes, No. 20 Parliament-street, C.E. Improvements in malleable cylinders used in engineering and architectural structures.

110. J. Harris, Ess Hill House, Newton Abbot, Devon. An improved semaphore target marker.

Dated Jan. 15, 1862.

114. T. Timmins, general caster, and T. Simmons, Birmingham. An improved bath, combining in itself the advantages of the hot air or Turkish bath with the vapour, slipper, hot and cold water shower bath.

116. H. D. P. Cunningham, Bury, near Gosport, Esquire. Improvements in means or apparatus for protecting screw propellers from entanglement or being fouled by ropes or other bodies, also improvements in means or apparatus for closing up the screw aperture.

Dated Jan. 16, 1862.

117. J. Brooke, Leeds, engineer. Improvements in the form of lubricators.

121. W. Tristram, Bolton, Lancaster, manufacturer. Certain improvements in power looms for weaving.

Dated Jan. 17, 1862.

125. J. M. Rowan, Glasgow, engineer. Improvements in the construction of steam hammers.

127. N. Thompson, 55 St. Paul's-road, Camden-town. Improvements in apparatus for stopping bottles.

129. R. Romaine, Devizes, agricultural engineer. Improvements in apparatus to be used in cultivating land by steam power, and in steam boilers used for agricultural and traction purposes.

Dated Jan. 18, 1862.

131. T. Emmott, Vale Mills, Oldham, manufacturer, and J. Travis, salesman. Improvements in the manufacture of velvets, velveteens, and other similar piled fabrics.

133. E. Davies, Warrington, gentleman. Improvements in apparatus for gauging and cutting soap.

134. W. Helme, Caldbeck, Cumberland. A new or improved fire-lighter.

135. J. J. Stevens, Darlington Works, Southwark. Improvements in "point" indicators for railways.

Dated Jan. 20, 1862.

143. T. W. Jobling, Point Pleasant, Northumberland, colliery viewer and mining engineer. Improvements in the adaptation of locomotive engines to traction or haulage in mines.

147. E. C. Nicholson, the Atlas Works, Locksfields, manufacturing chemist. Improvements in the preparation of colours suitable for dyeing and printing.

148. J. W. Agnew, Windsor Chambers, Great Saint Helens, gentleman. A new or improved kind of last, capable of being adjusted to various sizes and to various shapes of toes. (A communication.)

Dated Jan. 21, 1862.

151. J. A. Knight, 4 Symond's-inn, Chancery-lane. Improvements in the permanent way of railways. (A communication.)

152. J. F. Tourrier, 41 Manchester-street, Manchester-square. An improved method of, and apparatus for, warming adjoining houses by means of air chambers attached to grates in the party walls dividing such houses.

153. C. Binks, Gray's-inn. Improvements in generating steam, in superheating steam, and in apparatuses employed therein.

155. H. B. Barlow, Manchester. Improvements in machinery or apparatus for counting and indicating the number of revolutions of shafts or other articles, and for exerting power. (A communication.)

157. J. H. Rawlins, Hope Paper Mills, near Wrexham. Improvements in the machinery used in the manufacture of paper. (A communication.)

158. A. J. Martin, High-street, Bow, chemist and druggist. Improvements in the treatment of fusel oil, and for various applications of the same to useful purposes.

159. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in street and road sweeping machines, parts of which are applicable to the separation of liquid from solid substances. (A communication.)

161. M. Henry, 84 Fleet-street. Improvements in the mode of and apparatus for applying electricity to horology. (A communication.)

Dated Jan. 22, 1862.

163. L. Martin, chemist, Paris, 13 Rue Gaillon. Improvements in the treatment of mineral oils, and in the apparatus connected therewith.

165 F. W. Gerish, East-road, City-road, engineer. Improvements in printing presses.

166. E. Pace, Queen-street, manufacturer. Improvements in laths for Venetian blinds, in painting such laths, and in raising and lowering Venetian blinds,

167. A. J. Beer, Canterbury, engineer. Improvements in the valves of steam and other motive engines.

Dated Jan. 23, 1862.

172. J. Wallace, Haldane's Mill, near Alexandria, Dumbarton, smith and agricultural implement maker. Improvements in reaping machines.

174. W. H. Ropes, Crown-court, Old Broad-street, merchant. Improvements in machinery or apparatus for cleaning coffee, rice, or any seed or grain, having an outer hull and inner pellicle. (A communication.)

176. G. Rogers, Staines, Middlesex, plumber. Improved mechanical arrangements for letting-off water or other liquids from butts, vessels, or cisterns.

177. J. C. Johnson, Nottingham, lace maker. Improvements in the manufacture of twist lace in twist lace machines.

178. A. Ripley, Brook-street, Lambeth, engineer. Improvements in the construction of pistons.

179. H. Yates, Cecil-street, Strand, C.E. Improvements in machinery for bending, repairing, or renewing defective or damaged parts of iron rails.

180. J. G. Service, Glasgow, manufacturer. Improvements in machinery or apparatus for cutting and scoring pasteboard and other similar material.

Dated Jan. 24, 1862.

181. A. W. Williamson, University College, London. Improvements in tubulous boilers or steam generators.

182. J. Higgin, Manchester, cotton merchant. Improvements in machinery for retarding and stopping railway carriages.

183. J. Cornforth, Birmingham, manufacturer, and B. Smith, machinist. New or improved machinery for boring or drilling gun-barrels and tubes and other articles having a cylindrical or prismatic figure, which said machinery may also be applied to other like purposes.

184. W. Clark, 53 Chancery-lane, engineer. Improvements in the manufacture of artificial flowers, leaves, and fruit. (A communication.)

185. J. Longhurst, Ticehurst, Sussex, gentleman. Improvements in chains and chain cables.

186. J. Rock, Hastings, carriage builder. Improvements in common road carriages.

187. J. W. Girdlestone, Birkenhead, gentleman. Improvements in projectiles for fire-arms.

189. C. O. Hall, Regent-street. Improvements in the manufacture of boots, shoes, and leggings.

190. A. Wallis and C. Haslam, Basingstoke, Southampton, engineers and ironfounders. Improvements in thrashing machines.

191. J. Alison, Brightland, Reigate. Improvements in apparatus for tilling land by steam power.

Dated Jan. 25, 1862.

192. W. Baker, Downham, Norfolk, surgeon dentist. Improvements in fire-arms, adapted to prevent their accidental discharge.

193. W Johnston, Glasgow, metal merchant. Improvements in lamps.

195. J. C. F. Mougin, Paris. Improvements in barcelonnetts or cradles for children or for dolls.

197. D. Edleston, Halifax, dyer and finisher, and H. Gledhill, finisher. Improvements in means and apparatus for finishing textile and other fabrics.

198. E. A. Curley, 4 Green-terrace, New-river-head, Clerkenwell, gentleman. Certain improvements in sewing machines.

199. J. Wright, Rochester, civil engineer. Improvements in constructing works below water.

200. P. J. L. Lefort, Bothey, Belgium. Improved mechanical arrangements constituting a secret and invisible safety lock, applicable to iron safes and other depositories.

201. F. Roberts, Maiden Newton, and A. Roberts, Frome Vauchurch, Dorset. Improvements in apparatus for ploughing and cultivating land.

203. A. Samuelson, 28 Cornhill, engineer and iron ship builder. Improvements in hydraulic presses, and in the mode of working the same.

Dated Jan. 27, 1862.

206. S. A. Carpenter, Birmingham, manufacturer. An improvement or improvements in covering and combining strips or bands of steel for crinoline or crinoline skirts.

207. R. Martindale, Handsworth, gentleman. Improvements in globes and glasses to be used with hydro-carbon lamps.

208. C. W. Harrison, Lorimer-road, Walworth, engineer. Improvements in printing, stamping, embossing, perforating, and other like operations, and in the machinery or apparatus employed therein.

209. W. Orr, Greenock, sugar refiner. Improvements in machinery or apparatus for the manufacture of sugar.

210 J. Smith, Spring-row, Keighley, York, machinist. Improvements in the construction of covered rollers used in the machinery for preparing, roving, spinning, twisting, and doubling fibrous materials.

212. T. J. Robotham, Burslem, chemist, and N. Hackney, Hadley, agent, Stafford. Improvements in purifying p, glaze, and other potters' materials.

Dated Jan. 28, 1862.

216. J. Henkins, Bristol, stonemason. A new composition or wash to be applied to marine and other steam boilers to prevent incrustation.

217. J. Hunt, Birmingham, brassfounder. An improvement or improvements in the manufacture of gas and other chandeliers.

220. A. H. Church, 170 Great Portland-street, chemist. Improvements in the means of preserving stone, brick, slate, wood, cement, stucco, plaster, whitewash, and colour-wash, from the injurious action of atmospheric and other influences, also in the application of colours to the surfaces of stone, brick, slate, wood, cement, stucco, mortar, clay, plaster of paris, plaster, whitewash, and colour-wash, and in the retention of such colours thereon.

221. C. Culling, Downham Market, Norfolk. Improvements in fire-arms.

223. O. H. and E. Morgan, Grand Junction-terrace, Edgeware-road. Improvements in carriages.

224. G. Chapman, Rutland-street, Leicester. Improvements in rotating circular knitting frames.

225. G. J. N. de Ridder, 57 Rue Pigale, Paris, engineer. Improvements in railway carriages for the conveyance of travellers and goods.

Dated Jan. 29, 1862.

230. T. Clayton, mechanic, and W. Smith, overlooker, Knowlwood, near Todmorden, Lancaster. An improved flyer.

232. L. A. Palve, 15 Passage des Petites Ecuries, Paris, iron chest builder. Improvements in fire-proof iron chests and strong boxes.

240. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the boxes for the journals of railroad carriage and other axles. (A communication.)

242. M. Collier, Failsworth, Lancaster, manufacturer. Improvements in looms for weaving.

Dated Jan. 30, 1862.

246. E. A. Rippingille, Staple-hill, near Bristol. Improvements in engines worked by steam or other fluid, and in pumps.

248. H. Robottom and R. Underwood, 31 Robert-street, Hoxton, watch manufacturers. Improvements in watches and pocket chronometers.

250. W. Clark, 53 Chancery-lane, engineer. Improvements in mechanical wrenches. (A communication.)

252. A. Lahousse, Brussels, mechanician. Improvements in the manufacture of wheels for waggons, locomotive engines, and other vehicles used for railway purposes.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

298. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the manufacture of iron and steel. (A communication.) Dated Feb. 4, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2443. J. A. Knight. Boots and shoes. (A communication.)
2445. R. Nightingale. Marker's butts or mantelets.
2447. J. W. Scott. Leather rings, washers, and laces.
2455. J. Davis and T. Evans. Engines.
2456. W. Maltby. Starch and starch gum.
2462. C. G. Hill. Bonnet and cap fronts.
2463. J. C. Dickinson. Steam engines.
2467. H. Law. Docking of vessels.
2469. R. J. Ellershaw. Expressing oil.
2473. W. Malam. Manufacture of gas.
2477. C. Husson. Silvering glass.
2478. A. David. Fixing inscriptions.
2480. G. Knox. Paper-making machines.
2486. J. Tweedale. Preparing and spinning fibrous substances.
2487. J. Lansley. Agricultural implements.
2489. E. Partridge. Hardening iron and steel.
2492. J. S. Collins. Reefing and furling sails.
2494. G. Nares. Effecting communication.
2497. W. Squire. Shaping wood.
2502. G. K. Stothert. Condensing apparatus.
2506. A. Ford. Waterproof fabrics.
2523. W. Palmer. Lamps and lamp wicks.
2539. A. English. Reins.
2548. S. R. Carrington. Hats and caps.
2573. F. B. Baker. Dressing or stiffening lace.
2588. T. Wild and T. Hodson. Heating "feed-water."
2632. J. H. Johnson. Facilitating the passage of trains up steep gradients on railways. (A communication.)
2652. G. Davies. Railways. (A communication.)
2727. J. L. Norton. Raising water. (Partly a communication.)
2743. B. Mitchell and W. Brunton. Scissors and shears.
2855. W. H. Balmain and J. Kean. Manufacture of flowers of sulphur.
2935. T. W. Davenport and S. Cole. Buttons, heads, and picture frames.
3078. C. E. Varley. Electric telegraphs.
3184. J. H. G. Wells. Pumping elastic fluids.
24. E. Nogent. Fire-arms.
38. J. Coryton. Type machine.
69. H. Barber. Safety lamps.
127. N. Thompson. Stopping bottles.
132. T. Newton. Sights for rifles.
135. J. J. Stevens. Indicators for railways.
138. W. L. Winans. Manœuvring cannon or ordnance.
225. G. J. N. De Ridder. Railway carriages.
298. W. E. Newton. Iron and steel. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Feb. 5, 1862.

1948. W. and J. Galloway, and J. W. Wilson.
1968. J. E. and T. C. Eastwood.
1993. A. N. and A. R. Stocker.
1995. W. S. T. Clarke.
2001. A. Salomons.
2008. J. C. Horner.
2009. J. Jacob.
2011. S. Andrew and S. Hornby.
2012. J. G. Remy.
2024. E. Edwards.
2032. J. C. Martin.
2036. S. Desborough.
2092. C. Stevens.

Sealed Feb. 11, 1862.

2027. J. Billing.
2037. A. F. Menard.
2038. C. W. Kesselmeyer and T. Mellodew.
2042. T. Murcott and C. Hansom.
2043. J. Livesey.
2045. H. C. Hill.
2047. E. Sutton.
2079. J. Ellis.
2103. T. Richardson and R. Irvine.
2113. G. T. Bousfield.
2152. P. Jewell.
2153. A. V. Newton.
2179. J. M. Dunlop.
2197. G. Bischof.
2220. T. Greenwood.
2281. W. E. Newton.
2354. C. Perman.
2556. G. Twigg.
2576. A. V. Newton.
3066. J. J. Russell and B. L. Brown.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

333. R. Tinkler.
342. M. Curtis and J. Miller.
343. J. Lee.
346. J. Smith.
356. J. B. Redman.
380. B. Burrows.
383. J. Evans.
406. W. E. Newton.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

322. J. Ramsbottom.
441. G. M. Miller and J. Wakefield.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Feb. 8, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
1622	0	3	1636	0	3	1650	0	7	1664	0	5	1678	0	3	1692	0	3
1623	0	3	1637	0	10	1651	0	3	1665	1	2	1679	0	9	1693	0	10
1624	0	9	1638	0	3	1652	0	3	1666	0	7	1680	0	3	1694	0	6
1625	0	10	1639	0	7	1653	0	9	1667	0	6	1681	0	10	1695	0	7
1626	1	4	1640	0	10	1654	0	6	1668	0	11	1682	0	3	1696	0	3
1627	0	3	1641	0	3	1655	0	3	1669	0	10	1683	0	3	1697	0	3
1628	0	9	1642	0	3	1656	0	3	1670	0	9	1684	0	9	1698	0	5
1629	0	9	1643	0	9	1657	0	6	1671	0	11	1685	0	3	1699	0	3
1630	0	7	1644	0	3	1658	0	3	1672	0	10	1686	0	6	1700	0	10
1631	0	3	1645	0	9	1659	0	3	1673	0	3	1687	0	3	1701	0	6
1632	0	3	1646	0	3	1660	0	3	1674	1	5	1688	0	3	1702	0	3
1633	1	0	1647	0	3	1661	0	6	1675	0	3	1689	0	3	...		...
1634	0	3	1648	0	8	1662	0	3	1676	0	7	1690	0	7	...		...
1635	0	3	1649	0	3	1663	0	3	1677	0	7	1691	0	3	...		...

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Feb. 13, 1862.

		£	s.	d.		£	s.	d.	Dis. p.ct
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	0	0	0	nett
Welsh Bars, in Wales	"	5	5	0	"	5	7	0	3
Staf. Bars, at the Works	"	6	10	0	"	7	0	0	2
" Hoops	"	7	10	0	"	8	0	0	"
" Sheets, Singles	"	0	0	0	"	0	0	0	"
" Nail Rods	"	5	15	0	"	6	10	0	"
" Boiler Plates	"	0	0	0	"	8	10	0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2	7	0	"	0	0	0	nett
Do. No. 1, Good Brands	"	2	11	0	"	2	15	0	"
Scotch Bars	"	7	5	0	"	7	15	0	"
Swedish Bars, in London	"	10	10	0	"	11	0	0	"
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	"	0	0	0	3
Tough Cake and Tile	pr. ton	98	0	0	"	0	0	0	"
Best Selected	"	101	0	0	"	0	0	0	"
Australian	"	100	0	0	"	0	0	0	"
South American	"	0	0	0	"	0	0	0	"
Yellow Metal Sheathing	per lb.	0	0	9½	"	0	0	0	2½
STEEL:									
Swedish Keg	pr. ton	16	0	0	"	0	0	0	2½
" Faggot	"	14	0	0	"	0	0	0	"
TIN:									
English, Block	p. cwt.	6	1	0	"	0	0	0	2½
" Bar	"	6	2	0	"	0	0	0	"
Foreign, Banca	"	6	4	0	"	0	0	0	nett
" Straits	"	5	19	0	"	0	0	0	"
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	"	1	0	0	6
Coke, I.C.	"	1	1	6	"	1	4	0	"
LEAD.									
Pig, English	pr. ton	19	10	0	"	20	0	0	2½
" Spanish	"	19	5	0	"	19	10	0	"
Common Sheet	"	21	10	0		22	0	0	"
Tea " (Wimshurst's Patent) A special disct.	"	35	0	0	"	0	0	0	"
SPELTER:									
On the spot	"	18	0	0	"	0	0	0	nett
For arrival	"	18	5	0	"	16	7	6	"
ZINC:									
English Sheet	"	23	0	0	"	0	0	0	1
QUICKSILVER	pr. btl.	7	0	0	"	0	0	0	

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 21, 1862.

ON ANALYSING THE FORMS OF SHIPS.

We have recently been placing before our readers a paper on the above subject, read at the Scottish Shipbuilders' Association, by Mr. Robert Mansel, a member of that body, and it now becomes our duty to offer a few remarks upon it. It is not without very considerable pretensions, because its chief object is to facilitate (to say the least) the introduction of some general system, under which the forms of the various classes of ships built in this and other countries may be analysed, compared, and placed on record, for the guidance of future naval constructors. And the author's project for effecting this great object is preceded, moreover, by a series of investigations, which he considers "appropriate and useful" under the circumstances, "though somewhat lengthy."

It is no part of our present intention to discuss the system of analysis which Mr. Mansel brings forward, for two reasons: first, it appears certain to us that the absence of shipbuilding records of this kind is in no degree attributable to the want of an efficient means of recording the forms and qualities of ships, but solely to the indisposition which our most flourishing shipbuilders feel to make the nature and characteristics of their vessels known to the profession generally. Mr. Mansel, like so many other persons who speak and write on shipbuilding questions, seems to forget that shipbuilding is a trade in which success can only be achieved by professional skill—or, if this be not universally true, it is at any rate certain that this is what success is *supposed* to depend upon; and, consequently, our most successful shipbuilders are naturally, although not wisely, perhaps, averse to the display of the forms and qualities of their vessels before the profession generally, seeing that their knowledge would thus be made available, as they think, for all. We do not say that they are right in this; but we know that, whether they are right or wrong, the fact is what we state. Secondly, without entering upon the most substantial part of his paper, we find ample grounds for believing that Mr. Mansel would under no circumstances be accepted as a guide on so important a matter by the shipbuilding profession. He is not a sufficiently reliable exponent of the existing science and art of shipbuilding, to justify him in assuming to guide shipbuilders into new spheres of enterprise. It may be doing a real service to many readers if we take the pains to point out briefly a few of the defects which lie upon the very surface of the paper under consideration.

We will first notice what is, perhaps, the least of Mr. Mansel's faults, viz., a grandiloquence of style, wholly unbecoming a strictly technical scientific subject. He leads off his argument—or, rather, his discursive essay—thus: "Defining a ship as a water-borne "mechanism by which, subject to necessary "conditions, a given cargo may be transmitted "from one place on the earth's surface to "another, it is understood that this transmission is effected in a restricted time; or, in "other terms, that the speed is regulated by "human intelligence directing into certain "channels power obtained from natural "sources!" We should very much like, were it possible, to hear our shipbuilding friends express their individual opinions of this mode of commencing a theoretical disquisition on the forms of ships! To our English ears, such language employed for such a purpose sounds preposterous indeed!

We are not surprised to find that a gentleman who commences in this fashion should prove somewhat whimsical when he comes to deal with mathematical notations, and processes. This is notably the case in those portions of the author's remarks in which he discusses the various methods of ascertaining the areas of curvilinear surfaces. Ordinarily, it is the habit both of geometricians and of naval architects to denote the successive ordinates of a given curve, by a series of letters, each attended by a numerical suffix, denoting the position of its particular ordinate in the series. Thus the first ordinate is usually A_1, the second A_2, the third A_3, and so forth; the value of this arrangement being that it greatly facilitates the committal to memory of the various rules in which mention of these ordinates is necessarily made. For no apparent reason, however, beyond an affectation of novelty, Mr. Mansel sacrifices the real value of this notation, and gives us Y_0 for A_1, Y_1 for A_2, Y_2 for A_3, and so forth. This is not a very vital defect in his paper, but it is a real one, and one for which, as we have said, we can discover no sufficient or worthy motive.

In dealing with the abstruse question of a ship's stability, Mr. Mansel is neither less confident nor more satisfactory. He criticises men of splendid talents, like Bouguer and our own Atwood—men whose services to naval architecture will be remembered gratefully, and with admiration, as long as naval architecture itself shall last—he criticises these great men, we say, with all the air of a master—"the mechanical "principles in both their methods appear," he says, "to be identical, *and to a certain extent* "*inaccurate*"—and then goes on to develop what he conceives to be a new and very simple and sufficient view of the question. We are sorry to say, however, that his success in rivalling, and improving upon, Bouguer and Atwood is but imaginary. His investigation is neither clear, nor exact, nor even accurate; in fact, it is characterised by one blemish which cannot fail to make competent mathematicians and naval architects smile. The fundamental equation of stability is given in such a form that, in order to apply it practically, you would require to subtract a certain number of *tons* from a quantity obtained by multiplying certain *areas* by certain *lengths*, and summing up the products! The equation, as given by him, is,

$$\text{Stability} = \left(\frac{2}{3} \int y^3\,dx - W d \right) \sin.\ a.$$

Where y is the ship's half-breadth, x is the length of her water-line, d a certain distance, and W a *weight!* We can only account for such a blunder by observing that W is often used in this equation; but then when Atwood and others use it,[*] it is employed to represent a *volume* and not a weight.

In speaking of the centre of gravity of a ship, Mr. Mansel says, "This element, however important, is far too troublesome to calculate "directly, and, as a rule, is either vaguely "guessed at, or found by experiment after the "ship is built and laden." We think it important to observe that this is by no means always the case at the Admiralty, whatever may be the practice of some private shipbuilders. When the *Warrior* was designed, the height of her centre of gravity was estimated, not by a vague guess, but by an elaborate calculation carried out by a most expert naval architect, and, if we might judge from the behaviour of the ship at sea, we should surmise that, if the height of her centre of gravity is experimentally ascertained at some future time—as it ought to be, and we hope will be—it will be found to occupy a position very close indeed to that assigned to it by calculation.

We will only add that Mr. Mansel, in his desire to grapple with our highest authorities, falls into the error of supposing that Dr. Woolley did Chapman the injustice of alleging that his "curve of sections" is of no use except as a means of *designing* ships. Dr. Woolley expressly stated, on the contrary, that it was used successfully by Mr. Moorsom, in the Customs' Department, for an altogether different purpose. It was the application of this curve in Chapman's "parabolic system of *construction*," that Dr. Woolley condemned as tending to stereotype certain models for vessels, and to check improvement. He certainly did not condemn the system as a mere "register" of form.

We hope Mr. Mansel and his friends in Scotland will receive these remarks of ours in a proper spirit. We are delighted to see them stirring in these great questions of naval architecture; but we desire to see them walk before they run, or at any rate before they begin to leap and bound over the heads of such men as Bouguer, Atwood, Moseley and Woolley. We also think it would be wise to avoid such an attempt as that made in the Paper before us—an attempt to cram disquisitions upon ships in general, resistance, displacement, stability, the measurement of areas and volumes, the analysis of ships' forms, &c., &c., all into a single essay with a vague title.

THE HARTLEY COLLIERY ACCIDENT.

The causes of this dreadful catastrophe have now been fully discussed in the Mechanics' Magazine, as well as in the daily press. It appears clearly made out that the proximate cause of the disaster was the breaking of the spears or pump rods, and the consequent sudden strain thrown upon the cast-iron beam.

It has been suggested that nothing but wrought-iron should in future be employed as the material to be used for making the beams of pumping engines. To our thinking, this only attacks one half of the proposition. Conceding at once that wrought-iron is the proper material for the beam of a steam engine, we wish to direct the attention of the engineering world to the important fact, that it has for the last ten years been practically demonstrated that there is no necessity for the employment of any beam, in fact that the simple direct-action pumping engine, as supplied to the Aberdare, the Ebbw Vale Iron Works, the Nailsea coal pits, and many other important Welsh collieries, irrespectively of their exceedingly cheap and simple construction, by the very nature of the mechanical details, would effectually prevent the recurrence of the terrible calamity that has excited such universal sympathy.

The engine may be described as a cylinder fixed upon a strong wrought iron framing over one side of the pit, having a stroke of ten feet and a diameter of cylinder of 45 inches—the pump rods are directly attached to the piston,—there are two throttle valves, and the steam is throttled at its exit from the cylinder, thus the downward stroke is received on a cushion of steam, pressure of steam about forty-five pounds. There are but four bearings to the engine, and the wear and tear and attention required is not one-fourth that of the ordinary beam pumping engine.

The engines to which we have alluded have been in constant use for the past ten years, giving every satisfaction to the proprietors, and are well worthy of a visit and the careful inspection of those who are interested in this matter.

---

[*] We have not Atwood at hand, but we think he does use the W.

A drawing of these engines, with a full mechanical description, will be supplied in the next week's number of this Magazine.

PARAFFINE; ITS HISTORY, MANUFACTURE, AND APPLICATION.

> "It would certainly be esteemed one of the greatest "discoveries of the age, if any one could succeed in "condensing coal gas into a white, dry, solid, colourless substance, portable, and capable of being placed "upon a candlestick, or burnt in a lamp."

This opinion was expressed many years ago by one of the most sagacious of chemists, Professor Liebig, and perhaps at that period he little thought how comparatively soon a substance almost of the same chemical composition as coal gas, and embodying all the qualities he enumerates, would become an article of commerce, destined, in all probability, to supersede most of the other numerous sources of artificial light, and to make the productions of the *animal* and *vegetable* kingdom, which have yielded our chief supply for so long, subservient to the *mineral*.

Many organic substances, particularly those of a bituminous nature yield, on distillation at moderate temperatures, a white waxy-like substance, containing the same elements as coal gas and in the same proportions. This substance, perhaps one of the most extraordinary with which we are acquainted, was originally discovered by Reichenbach, in tar, but it may also be obtained, in smaller quantities, by the destructive distillation of wood, or by distilling bees'-wax, when intimately mingled with lime. A species of mineral coal, commonly known as Boghead coal, or Torbanehill mineral, also yields a large supply, but the greatest care and delicacy are requisite for its production, as a mismanagement of the temperature, or a too speedy application of heat, would, if it did not entirely prevent its formation, materially interfere with the economy of the process.

This substance is known as *paraffine*, from the two words *parum affinis*, an excellent and highly significant appellation, as unlike nearly every other body, it possesses little or no inclination to combine with other substances, and has a wonderful power of resisting the action of the most energetic re-agents. Thus, sulphuric acid (oil of vitriol), one of the most corrosive substances, has no effect upon it at ordinary temperatures, although wax, spermaceti, stearic acid, &c., are converted into a blackened mass, when submitted for one moment to its influence. Nitric acid, again, which oxidizes with astonishing rapidity nearly all organic bodies, fails to exercise an action upon paraffine, unless, indeed, at an elevated temperature. When a gentle heat only is applied, the paraffine melts, and floats unharmed upon the liquid. The strong alkalies also, as potash and soda, which saponify almost instantaneously the generality of oils and fats, do not form any kind of soap with paraffine.

It may be useful to give a brief sketch of this interesting body, which may be conveniently divided into,

1st. The history of its production.

2nd. Process of its manufacture.

3rd. Its application and advantages for the development of artificial light.

First, then, the history of its production.

It has previously been remarked that [illegible]chenbach was the discoverer of paraffine. [illegible] is elaborate researches upon the products [illegible]d from the distillation of tar and bitu[illegible] matters, it being one of those embraced [illegible]ng list of substances he obtained, [illegible]ach may be mentioned, creosote, picamar, eupion, cedriret, pittacal, and capnamor, but it was necessarily regarded by him merely as an interesting chemical product, useless for the purposes of domestic light, on account of the difficulty of its formation. It must not be supposed, however, that Reichenbach was the first who discovered substances derived from bitumen, which might be made conveniently available as sources of illumination. A patent was granted more than a century ago (1746) to Mr. Hoskins, for his treatment of bituminous schists, and the late Earl of Dundonald, who appears to have had among his many avocations an untiring interest in this department of technology, also had a patent in 1781. Even before the time of Hoskin, Dr. Hales, in describing some experiments conducted by himself in 1721 on coal, speaks of a volatile oil, which he condensed in a vessel attached to the still.

With the exception, however, of some remarkable results obtained by Mr. Northern, of Leeds, and which he communicated in 1805, no very great progress was made in this department of photogenic science, until a very few years ago, when Mr. James Young, of Glasgow, obtained a patent for distilling paraffine oil from coal, by which he collected both solid and liquid products, separating them one from another in a very perfect and ingenious manner, and there can be little doubt, that from the magnitude of his operations, and the originality of his ideas, he should be regarded as the pioneer of this branch of industry.

As recently as 1854, Reichenbach wrote, "So remained paraffine until this hour, a beautiful item in the collection of chemical preparations, but it has never escaped from the rooms of the scientific man." A few years afterwards it was made by tons!

It has been a favourite idea, not yet, perhaps, entirely abandoned, to derive from the immense stores of peat, found in some parts of Ireland, an endless quantity of paraffine.

Small specimens of a dazzling white substance, transmitting light as clearly as the finest camphor, were displayed.

The amount of peat was calculated, not in millions, but in billions and quadrillions of tons, and from its black and uninviting structure, this beautiful body was to be obtained, converting a hitherto useless tract of country into an abundant source of wealth. The idea was altogether a practical one; striking, indeed, not only the practical, but also the imaginative mind. The speculator saw in it a vast magazine of wealth; the philanthropist, a fruitful field for the development of a nation's industry; the chemist, a great and crowning circumstance of the triumphs of analytical skill, the elimination of a white crystalline body, hidden in those dreary wastes of blackened bog for immemorial centuries. But these golden visions were not to be so easily realized. Paraffine was there, and when extracted was found to be of the very finest quality, but it existed in minute proportions, and the cost of the extraction was very heavy. To give some idea of the homœopathic quantity contained in peat, an analysis of that substance may be given.

One hundred parts of peat yield on distillation.

Watery Matters	30·614
Tar	2·932
Gases	62·392
Ashes	4·197
	99·595

The watery matter and tar yielding,

Ammonia	0·287
Acetic acid	0·207
Naptha	0·140
Volatile products	1·059
Paraffine	0·125

thus showing in practice a very small percentage of this particular product, from which such great results had been anticipated. Much of the peat, or turf, as it is termed, from the Kingdom of Hanover, yields it in larger, but not altogether in satisfactory proportions. For instance, 100 parts of air dried turf yielded,

Light Oil	1·7633
Heavy Oil	1·7715
Asphalte	1·5582
Paraffine	0·3005
Coke	33·3120
Water	40·0000
Gas	15·6250
Creosote	3·6695
	100·0000

Thus in this instance it appears that about 3,000 lbs., or rather more than 1 ton 7 cwt. of paraffine may be derived from one million pounds, or nearly 450 tons of turf.

Mr. Rees Reece obtained a patent in 1849 for distilling paraffine from Irish peat, and an establishment was erected near Athy, in Ireland, for its production. The principle, as far as I can learn, appears to depend upon driving a strong current of heated air from below, over the products in a state of slow combustion above, and thus carrying them over with the other vapours.

The number of patents granted to various parties for the production of paraffine, paraffine oils, and other photogenic products probably exceeds that obtained for any other branch of technology, excepting, perhaps, for the manufacture of sulphuric acid. From March, 1852, to January, 1860, forty patents were registered in the United States, the first one being by Mr. Young, of Glasgow, In Great Britain, from 1746 to 1858, five and forty were granted, out of which forty were sealed during the last ten years. Besides these, which were for the general manufacture of the substance, twenty-two were obtained for improvements in apparatus for distillation, making a total of sixty-seven. In France fifteen were granted for general manufacture, and eleven for apparatus, making a total of twenty-six.

Second. Processes of the manufacture of paraffine.

It has previously been remarked that paraffine may be derived from the action of heat at a comparatively low temperature upon many organic bodies. It is always found among the products of distillation, dissolved in various oils of different specific gravities, from which, upon depressing the temperature, the solid paraffine crystallizes out in scaly masses, and may be partially purified by simple pressure.

The importance of attending to the amount of heat applied to the material from which it is proposed to extract the paraffine, cannot be too emphatically insisted on. Tars, when formed at a moderate temperature lower than that usually employed for the manufacture of gas, contain naptha, a certain amount of benzole, paraffine, and napthaline, and when a high cherry-red heat has been applied, the tars are free from paraffine, the white crystalline compound sometimes mistaken for that body being napthaline. "Hence," says Dr. Antisell in his excellent little work upon photogenic oils, "as "napthaline is produced at high temperatures, "at which paraffine does not form, and as the "production of the valuable oils is accompanied with the *slow* production of the latter "solid, and as the production of paraffine goes "on abundantly at a temperature when the "light oils have ceased, we have in this "statement of the circumstances, pointed out "the conditions of temperature which are "necessary to be observed in distillation. The "temperature must be *above* that point at "which naptha or benzole is produced, it must "be *below* that at which napthaline is formed, "within this range paraffine is produced, and "the desirable temperature, therefore, is be- "tween the formation of naptha on the one "hand, and the abundant formation of naptha- "line on the other."

As the production of gas begins where that of paraffine and its congeners ends, the importance of regulating the heat can be easily understood, and, as a consequent, the two processes cannot be carried out simultaneously. Paraffine, the desired solid, portable gas of Liebig, becomes ordinary gas at higher temperatures. Hence, in gas-works, which have for their object, as their name implies, the production of invisible air, destined to pass through interminable miles of pipe, ultimately to be consumed in our streets and dwellings, little or none of the solidified gas is yielded, "white, portable, and inodorous."

This is formed at a far lower stage of decomposition, but can be carried in the hand from house to house, and from room to room, and may be transported thousands of miles away beyond the sea.

In order to avoid any great elevation of temperature, and thus prevent the loss of the valuable products, many ingenious plans have been devised to obtain a constant and equable degree of heat. By ascertaining the exact fusibility of certain metals and their alloys, this can be established satisfactorily.

The still has merely to be immersed in a bath of the metal, just heated to its fusing point, and the proper degree of heat may be maintained exactly throughout the entire process of distillation.

David C. Knab patented a process of the kind in 1853, involving the use of baths of fusible metal, which produced the amount of heat required for distillation. He made baths of the following substances :—

1. 4 parts of tin,	10	of lead,	470°	Fahr.
2. 4	„	13	„	486	„
3. 4	„	18	„	505	„
4. 4	„	27	„	525	„
5. 4	„	38	„	542	„
6. 4	„	70	„	558	„
7. Lead alone				610	„
8. 3 of tin and 2 of zinc				662	„
9. Zinc alone				680	„
10. Antimony alone				797	„

Knab found that some of the first in the series serve for the distillation of wood, while seven, eight, and nine, are suitable for the distillation of turf, peat, and bituminous schists, for the economic production of paraffine. The liquid and tarry products obtained at these temperatures are mixed with about four parts of sulphate of iron, and digested for an hour at a moderate heat. This process serves to separate the sulphur which exists in the tar as sulphide of ammonium. It is then introduced into distilling vessels, and heated by means of superheated steam. The oils which come over, are separated by fractional distillation, as follows :—

1. Volatile oil, sp. gr. 0·700 to ·865.
2. Heavy oil „ ·865 „ ·900.
3. Paraffine „ ·900 „ ·930.

No. 3 is placed in a vat, the temperature is depressed, and the solid portions crystallize out after some weeks, in large scales, and by an ingenious contrivance, in which the centrifugal force is called into play, the solid and liquid portions are separated. The paraffine is then melted and run into squares, and submitted while cold to the hydraulic press under a pressure of about 300,000 lbs. It is re-melted, and treated with about half its weight of strong sulphuric acid at a temperature of 356 Fahrenheit. At the end of two hours the paraffine separates from the acid, and is washed with water; it is then run into cakes, and pressed while hot in the hydraulic press; again melted, mixed with caustic potash, which precipitates all impurities, leaving the paraffine as limpid as water. The use of spirit for the purpose of dissolving the pitchy and tarry matters, is resorted to by many manufacturers.

There are doubtless many varieties of paraffine, as specimens obtained from various sources have different fusing points. When the melting point is low, the paraffine is technically called *weak*, the stronger kinds are used in the manufacture of the best candles. Regnault puts the fusing point at 116° F., while Kane gives it as 111° F. Bolley mentions some as high as 149°, or considerably above that of the best bees' wax, and Laurent has experimented upon a sample which was liquid at 92°, or lower than the melting point of tallow. Fillipuzzi examined a specimen made by Young, of Glasgow, from bituminous slate, which appeared to be very pure, having neither colour, odour, nor taste. If partially dissolved in alcohol, and separated on cooling in a semi-crystalline mass, which could be divided by extreme care, into nine distinct portions, each portion having a different fusing point.

No.	1	2	3	4	5	6	7	8	9
Temperature	113°	118°	120°	121°	123·5	133·5	136	137	139

To give some idea of the quantity of tar distilled from the various coals, &c., and the products derived from the re-distillation of that tar, the following experiments may be cited, taken from Antisell's work :—

1 ton of	Pelton main coal	yields	102	lbs. of tar.
„	Newcastle Cannel	„	98	„
„	Wigan	„	248	„
„	Youghgelly Cannell	„	225	„
„	Ramsey Cannell	„	295	„
„	Derbyshire deep main	„	219	„
„	Lismahago	„	598	„
„	Boghead	„	738	„

100 parts of firm dark brown turf yielded 4·89 per cent. of tarry products, and 100 parts of these products upon re-distillation gave—

Photogen[*]	8·90
Solar oil	22·56
Solidified paraffine mass	39·73
Carbonaceous residue...............	22·60
Loss	6·21

Brown turf with a fibrous mossy structure gave 5·91 tar, 100 parts of which yielded—

Photogen..............................	7·32
Solar oil	21·66
Paraffine mass.........................	46·03
Carbonaceous matter...............	12·77
Loss	12·22

Brown coal gave 5·96 per cent. tar, which yielded in 100 parts—

Photogen	8·05
Solar oil	45·47
Paraffine mass.........................	28·52
Carbonaceous matter	13·09
Loss	4·87

Paper coal yielded 25·11 tar, 100 parts of which gave—

Photogen..............................	32·50
Solar oil	6·33
Paraffine mass.........................	51·25
Carbonaceous matter...............	8·92
Loss	1·00

100 parts of the crude substances yield, therefore, as follows :—

	Photogen.	Solar Oil.	Impure Paraffine.
1. Turf	0·435	1·104	1·943
2. Turf	0·380	1·124	1·380
3. Brown coal......	0·480	2·710	1·700
4. Paper coal	8·160	1·590	12·870

Paper coal is, therefore, particularly suitable for the manufacture of paraffine.

Third. The application and advantages of paraffine for the development of artificial light.

The pure and beautiful light which paraffine yields, its perfect freedom from grease, and its clear translucent appearance, render it invaluable for the production of the superior classes of candles, and since its make has so wonderfully increased, and the method of its manufacture so greatly improved, these candles manufactured by the Messrs. Field, Her Majesty's chandlers, of Lambeth, are far from expensive, and when their illuminating power is taken into consideration, as well as the curious fact that their combustion is much slower than that of any other varieties, such as wax, sperm, &c., it may be open to question if they are not the *most* economical of any description of candle whatever.

Another incidental advantage may likewise be mentioned.

There are many who prefer for their drawing rooms coloured candles, red, or blue, or green, but have hitherto been deterred from using them, owing to their inferior burning capabilities, caused by the large amount of incombustible colouring matter which it has been found necessary to introduce in order to bring them to the required tint. From the transparency of paraffine, a much smaller proportion is required, so small indeed, that there is no difference in the illuminating power of the coloured and the white. The beautiful compounds lately formed by Mr. Perkins, Messrs. Simpson, Maule, Nicholson, and others, all of organic origin, impart to these candles as well as to other articles, the most chaste and delicate tints, red, mauve, violet, crimson, and rose colour, which can possibly be imagined, and when it is remembered that these colours also are derived from the oxidation of a base found amongst the distilled products of coal, and have existed in different states indeed, but still existed, side by side with each other in the very foundations of the earth, it is certainly a curious fact that the light-giving and colouring principles are both obtained from the decomposition of gigantic forests and spreading ferns, the vegetation of a grand and prolific flora of thousands of ages ago; that they should be recovered by the hand of science from their associated congeners, to meet once more—resuscitated and individualised—the rose, the crimson and the glowing purple mingling with the white—the luminous taper being tinted with colour coeval with its own creation.

How wonderful to trace the circulation of matter in nature, even in such an apparently simple thing as a burning candle.

Paraffine has existed in other forms for millions of years, perchance in the rain and the atmosphere which fostered the tree, and the shrub, and the tender flower, flourishing in worlds now passed away. Vegetation seemed to perish, and leave no trace behind; but Nature, ever working, was storing the relics, to accumulate them in the exhaustless coal beds, destined to illumine the inhabitants of the worlds to be. And now, as the taper grows smaller and smaller, who can tell what part those products of its combustion will have to play in the economy of the universe. They are not lost, but will enter once more into the foliage of the Future, as the same products entered into the foliage of the dim, mysterious Past. Thus, by an eternal round, paraffine may reproduce paraffine, as a grain of wheat produces a grain of wheat.

On reflecting upon the history of artificial light, we may also trace distinct phases in the social condition of the world.

The savage, rude and violent in all his actions, did not even wait to prepare the grease flowing from the slaughtered quarry, but lighted his dwelling with the blazing pine torch, or resinous faggot, hewn from the fastnesses of his native forests. As time rolled on, and pastoral pursuits and the genial spirit of agriculture filled the land with flocks and cattle, man sought in the fat of animals a more convenient and enduring source of light, and the torch and blazing pine branch gave place to the candle and the lamp. As civilization still progressed, and man, weary of spending the long winter evenings in darkness, or by the uncertain and fitful gleam of his rude manufacture, sought far and near for light-giving material, and the sea itself was ransacked for its stores, and the seal, the walrus, and the mighty whale, yielded each its tribute in oleaginous supply.

---

[*] A light oil, which distils over at 200° Fahr.

Then came a new and important phase, when vast machinery was brought to bear, and the palm, the cocoanut, and a hundred variety of seeds, were expressed for their valuable oil. And, as though living Nature, prolific as she is, could not meet the perpetual demand forced upon her, the dead organism of a former world was disinterred, giving heat and light to the generations dwelling upon this. Who can foretel the discoveries yet to be made, by careful researches, upon the products of a bygone time?

Greville F. (Surbiton.)

MARK ISAMBARD BRUNEL.*

Sir M. Isambard Brunel was one of the most remarkable men of his time, and Mr. Beamish has related the principal facts and events of his life with considerable effect. Knowing Brunel well, and having many opportunities to gauge his character, Mr. Beamish has recorded with a loving and reverent hand the main points in the history of his departed friend. The book before us is full of valuable data; it refers to inventions, struggles, and circumstances which affect and colour, in no small degree, the interests, honour, and national greatness of England. It speaks of the progress of mechanical science in this country at an important period of its history; it affords glances into the characters of several eminent scientific men and ministers of state, and it shews what a single suggestive and persistent mind can do to develope the resources of a nation.

Mark Isambard Brunel was born at Hacqueville, in Normandy, on the 25th of April, 1769. Unlike Telford, and other eminent engineers, whose histories have recently been sketched in our columns, Brunel did not spring from the labouring class. His father enjoyed, and usefully appropriated, a limited income; and one of the objects of his ambition was to bestow on his son a classical education, so that he might be fitted for a high position in the church. That Brunel was not the son of a working man, and without education when young, speaks all the more in his favour. It is hard for those who are born in the lap of luxury, with few incentives to action, to make a name for themselves in the engineering world. Difficulties are the best educational appliance; obstacles are the stepping-stones to improvement. It matters not how low a man may be in the social scale, if he possesses the right stuff in his nature, he must of necessity succeed. What to other men would be insurmountable impediments, become playthings in his hands. Arkwright, Watt, Brindley, and others, swept difficulties from their pathway with comparative ease, because they possessed the requisite native power. Had they, however, been "born with "silver spoons in their mouths," did they inherit wealth and titles, the probability is that this native force would not have been called forth. When, therefore, we see a man of education or wealth becoming an inventor, it is all the more to his credit.

Brunel's father, with all his anxiety and care, could not impart to his son a liking for the church. It appears that no efforts on the part of his teacher at school, and no punishment inflicted at home, could induce him to pay as much attention to classical study as to the carpenter's shop and wheelwright's yard in his native village. He inherited an inventive genius, and he answered his intended purpose by studying and applying the laws of mechanics to multiplying the means of production, and thereby increasing human happiness.

At eleven years of age, when at school in Rouen, his love of tools was so inveterate, that he was known on one occasion to pawn his hat to buy them. At the age of twelve he is reported to have constructed various articles with as much precision as a regularly educated workman. Unable to repress the growing tendencies of the boy, the father consented to his becoming qualified to enter the navy. Young Brunel accordingly received lessons from M. Dulagne, of Rouen, the learned author of a treatise on hydrography. After a short time the teacher became so impressed with the abilities of the boy that he introduced him to the notice of the Minister of Marine, upon an occasion of his visit to Rouen. The minister in return, being impressed, was induced to nominate him "voluntaire d'honeur," before the usual time, to the corvette "Le maréchal Castries." It may be mentioned here, as an evidence of the unmistakeable ability of Brunel, that when introduced to the captain of the vessel in which he was to sail, a quadrant on the table particularly attracted his attention. He had never seen such an instrument before, and on being told its use, he carefully examined it without touching it. In a few days he constructed a quadrant, his only guide being a theoretic description in a work on navigation supplied to him by his master. Having succeeded so well in his first attempt he afterwards executed in ebony another instrument, and during the period of his connection with the navy he required no other.

Brunel followed the naval profession from 1786 to 1792. But little, however, is recorded of his history during those six years. In 1893, he found himself in Paris with his ship paid off. Then, says Mr. Beamish, events were succeeding each other with a rapidity unparalleled in the annals of human passion. Mr. Beamish can see nothing in the history of the French Revolution but a mere upheaving of popular fury. He cannot see that a great nation, suffering from aristocratic misrule, was passing through the terrible agonies of a new birth. To other and to equally far-seeing minds that revolution was something more than "an iniquitous period." To those minds, with all its blood and passion, it was the inauguration of a better state of things than the rotten regime which preceded it. Such considerations, however, belong to the moralist, politician, and general historian.

Brunel, like everyone else, was influenced by the general disruption of French society; and being a loyalist, he soon got into collision with some red-hot republicans, which very nearly ended in a fray. Fortunately, he escaped, and the following morning he left Paris. Had he remained, most likely his loyal proclivities and ardent temperament would have conducted him to a prison, or led him to the scaffold. From Paris he went to Rouen, where he remained for some time undisturbed, with some friends of his family. While there he met with a Miss Kingdom, a young English lady, to whom he became deeply attached, and who reciprocated his attachment. With this episode commences a beautiful, and rather romantic chapter in Brunel's career; but inviting as it is, we will not enter on it any more than to say, the young couple nurtured their love for each for years, while the one lived in America, and the other in England. The lady was ultimately the loadstone which drew the mechanist across the Atlantic, and which induced him to adopt England as his country and his home. The love ripened into marriage, and nearly a half a century of a mutually satisfactory wedded life was the result. At a late period of his life, he attributed all his success to his wife.

Brunel fled from revolutionary France to find a refuge in republican America. He, however, no sooner congratulated himself on his successful escape from the shores of his own country, than he found that his passport, which had been obtained through difficulty and manœuvre, was lost. This loss, to almost every other person, might have proved fatal. Brunel, who was born to conquer difficulties, got over this one with comparative ease. He borrowed a passport from a fellow-traveller, and copied it so accurately, in every minute detail, including the seal, that it was deemed proof against all scrutiny. This was no sooner done, than a French frigate hove in sight. A signal was made for all passengers on board of the American vessel to parade on deck, that their passports might be examined. Brunel, courageous and self-composed, was the first to present his passport, which he had so recently forged, and not the slightest doubt was aroused as to its authenticity. Had he no such credential, he would, no doubt, have been arrested as a *suspect*, and taken back to France, perhaps to perish.

The next chapter of Brunel's history opens in America. During a voyage from Albany to New York in company with his friend and fellow-traveller, Pharoux, he made the acquaintance of Mr. Thurman, a New York merchant. Before the voyage was ended, this Mr. Thurman, who is represented as a man of great penetration and ability, engaged the two young Frenchmen to survey a line for a canal to connect the Hudson River with the Champlain. This engagement became the turning point of Brunel's life. It was his intention, when tranquility was restored in his country to return thither, and follow the naval profession. After a short time France and her brilliant naval service were abandoned for America and the humbler profession of a civil engineer. Whilst surveying the line for the canal, Pharonx, to whom Thurman had confided the conduct of the operations, conscious of his inferiority, generously resigned the command into the hands of his more gifted companion. Thus Brunel, by the force of his character, was placed first in position. His attention was now directed, says Mr. Beamish, "not only to the projection of "canals, but the improvement of the navigation of rivers. His ingenuity soon suggested the means of freeing the beds from "masses of rock and embedded trees, and by "lateral cuts, of evading falls and cataracts, "which rendered navigation not only dangerous "but impracticable. He may, therefore, be "considered as the pioneer of those great "inland communications which have tended so "largely to promote the prosperity of the "States. The connection so auspiciously "formed with Mr. Thurman opened to Brunel "other and more brilliant opportunities for the "exhibition of his constructive talents. Success "attended all his efforts, and thus, in the

---

* "Memoir of Sir Mark Isambard Brunel." By Ric ha Beamish, F.R.S. London: Longman, Green, L ongma Roberts. 1862.

"course of less than twelve months, he had "achieved a name and secured an independence." We scarcely think that Brunel's success in America was so extraordinary as to call forth such a warm eulogy. But there can be no doubt that the young mechanist exhibited considerable ability, and that he lost no opportunity in turning circumstances to a good account.

We next see him in a new character. Architects being invited by the American Government to send in plans for a new council-chamber worthy of the increasing business of the States and the dignity of Congress, Brunel appeared as a competitor, and so superior were his plans in arrangement and elegance to all others that the judges had little difficulty of selection. Considerations of economy intervened to prevent the building of the new national structure. Plans, however, being soon after demanded for a new theatre in New York, and Brunel's original design, with some considerable modifications, were accepted. Brunel had now risen so high in the estimation of the citizens of New York, that they resolved to appoint him their Chief Engineer, and in that capacity he was soon called upon to furnish designs for a cannon foundry. Left free, says his biographer, to solve the problems presented to him, he very soon organised an establishment for casting and boring ordnance, which, from its novelty and practicability was considered at that time unsurpassed. When dining on one occasion with Major-General Hamilton, Washington's aide-de-camp, Brunel was particularly struck with the conversation of a M. Delabigarre, who had just come from England. That gentleman had directed his special attention to naval architecure, and the materials of ships-of-war, and particularly of ships' blocks. He described the machinery in use at Southampton by the Messrs. Taylor for the manufacture of such articles. Brunel after listening with attention, pointed out what appeared to him defects in the production, and suggested that the mortices in the hulls of the blocks might be readily cut with chisels, two and three at a time. We shall bye and bye see how admirably he put into practice at Portsmouth the suggestions which he originated in New York.

Brunel was evidently not a very easily satisfied man. Though the citizens of New York made so much of him, he entertained the opinion that his genius did not receive adequate reward in America, and he resolved to leave it. After declining repeated invitations to return to his own country, in January, 1799, he bade adieu to America, and in the following March landed at Falmouth. He was shortly after married to Miss Sophia Kingdom.

In the month of May of the same year, Brunel took out his first patent in England. It was for a duplicate writing and drawing machine. He also invented a machine for twisting cotton-thread and forming it into balls. This machine, which measured the length of the thread which it wound, and proportioned the size of the ball to its weight and firmness, not being protected by patent, became rapidly and generally adopted without bringing any pecuniary advantages to the inventor.

Mr. Beamish is not only an admirer of the character of the elder Brunel, but he is disposed to magnify his deeds at the expense of other, if not greater, men. The impartial pen of history, however, will put each man in his rightful position, independent of our individual prejudices or convictions. So intent is Mr. Beamish, at all hazards, to exalt his hero, that he puts him on too high a pedestal and claims for him undue credit. We have already seen that Brunel, while in America, suggested how ships' blocks might be made more expeditiously and economically by machinery, and he was not long in England before he endeavoured to carry his suggestions into practice. In vindicating the superior claims of Mr. Brunel in relation to the machinery for the manufacture of ships' blocks, Mr. Beamish breaks a lance with the Mechanics' Magazine. He enters into a long and elaborate defence of Mr. Brunel in answer to an article which appeared in this Journal on the 3rd of April, 1853. Any one reading Mr. Beamish's statement without seeing the article to which he professes to reply, will say at once that more credit was due to Mr. Brunel than to Sir Samuel Bentham in reference to the introduction of machinery in our national dockyards, and that the Mechanics' Magazine was wrong in its consideration of the superior claims of Sir Samuel Bentham; but let any one read the article referred to, and he will say at once that Mr. Beamish is more of an advocate than a judge, more of a partizan than an impartial historian. As this question affects the honour and exact historic position of two distinguished men, we consider that it deserves a little attention.

In January, 1852, Prof. Willis, in a lecture delivered before the Society of Arts, when speaking of the advances made in mechanism at the end of the last century, said: "Foremost "amongst the ingenious persons who carried "on this great movement must be recorded "Brigadier-General Sir Samuel Bentham." The professor said further, that "in the year "1797 the introduction of machinery for the "preparation of blocks and other works takes "its origin. In 1802 the General received a "most powerful and efficient auxiliary in the "person of Mr. Brunel. . . . At this "distance of time it would be impossible to "discover the exact shares of merits and invention which belongs to Brunel, Bentham, and "Maudslay in this great work." On the 3rd of April following, a writer in the Mechanics' Magazine takes up the question, and gives the palm, without any hesitation, to Bentham. Mr. Beamish, in his elaborate reply, endeavours to transfer the lion's share of glory from Bentham to Brunel. We consider, however, that he has not succeeded in his attempt; we must, however, postpone the remainder of what we have to say on the life of Brunel till next week.

Literature.

A Manual of Civil Engineering. By William John Macquorn Rankine, with numerous diagrams. London: Griffin, Bohn, & Co., Stationers' Hall Court. 1862.

In the work before us Professor Rankine has established for himself a yet higher claim to the gratitude of students of civil engineering than any he had previously advanced. This in itself is no trifling praise, for our author has for many years been recognized as an indefatigable exemplar and teacher of the principles and practice of engineering. As Regius Professor of Civil Engineering and Mechanics in the University of Glasgow, indeed, his fame has extended itself far and wide, and many of those young engineers who are now employed at home and abroad in the execution of works which are destined to promote civilization, and to further human happiness, owe their early instruction to the lucid and practical lessons of Professor Rankine.

The "Manual of Civil Engineering" might without any impropriety be termed an *encyclopædia* of the science, for it touches, and that with a master hand, every branch of it. Commencing, naturally, with engineering surveys, and fieldwork, into which, with elaborate and painstaking minuteness it goes, the work proceeds by systematic arrangement to deal with all the subsequent details involved in the curriculum of engineering. Surveying by the chain, and by angular measurements, have each a chapter devoted to them, and the information conveyed in both is of so intelligible and eminently practical a character, that to err under its guidance seems to us to be next to an impossibility. Levelling in all its varieties, by the theodolite; by the plane-table; by the barometer; and by the thermometer, is treated of in so patient, explanatory, and clear a way, as that it cannot fail to recommend itself to the tyro, whilst the practical hand may derive therefrom hints for economizing time and labour. "Setting-out," in all its diversified ramifications in connection with railway works, &c., &c., forms the subject of Chapter VII. of the first part of the "Manual," which part concludes with treatises and instructions on "Marine surveying for engineering purposes," and for "copying, enlarging, and reducing plans." In regard to the last named process, that of reducing plans, it is agreeable to find that the beautiful art of photography has been successfully applied. The large plans of the Ordnance Survey drawn on a scale of $\frac{1}{2500}$, to the scale of six inches to a mile have been in fact reduced by photographic means. The details of the plans so reduced are afterwards traced on the copper plates, on which the stations have been previously plotted by the lengths of the sides of the triangles. A process of transferring the reduced outlines to copper, zinc, or stone without tracing has been recently introduced.

Part II. of the "Manual of Civil Engineering," touches upon the vital points of "Materials and Structures." It would be simply impossible for us, in the space at our disposal, to follow the talented author of this exhaustive and comprehensive work through the various sections into which this branch of his subject is divided. It must suffice to say that he appears to have omitted no single item in relation therewith which the advanced intelligence, and scientific status of the time, demand should be noticed. A systematic and progressive arrangement of matter is visible, almost without exception, throughout the part now under consideration, and it need not be urged to what an extent this facilitates the labour of the student. A general summary of Principles of Stability and Strength opens up the part. This is followed by a Summary of Principles of the Balance of Single Forces and Couples, another on the Balance and Stability of Frames, Chains, Ribs, and Blocks; and then we reach a very important, not to say momentous division of the Manual, treating of the "Strength of Materials in General." To the practical engineer, the architect, and the builder, this section will, we unhesitatingly say, be found equally valuable. It might be well printed separately, indeed, in the form of a hand-book, to be ever on the desk or in the pocket of those who are engaged in the construction of such works as fall to the share of the professional men named. Masonry, in the shape of sub and superstructures of every material and kind, together with technical and practical instructions of a nature to lead one to suppose that the writer had been an engineering contractor, of vast and varied experience, rather than a university professor,—follow in their due order. Then comes carpentry; and timber work, in its every form, shape, and application, closely attends upon it. "Metallic structures," in which figures iron in all the thousand and one forms in which that material is now employed, follows, and forms an extensive section of the work, that section being completed by a chapter on "Metals and "Alloys," and another on "Underground and "Submerged Structures."

In Part the Third, and last, of Professor Rankine's "Civil Engineering," we come to what the author terms a consideration of "Combined Structures." These include roads, tramways, railways, and all that pertain to them; means of collecting, conveying, and distributing water, reservoirs, canals, tidal harbour and coast works, not omitting coast defences. In respect to breakwaters and sea defences generally, Professor Rankine modestly suggests a reference to the works of Smeaton, Telford, and the Rennies.

In conclusion, we must say in reference to the 766 pages which make up the Manual—independantly of appendices and carefully arranged indices—that the utmost care appears to have been bestowed in their preparation, and that if there is a fault with the matter of which they are composed, it is that it is too much condensed. The author, in contradistinction to some others who might be named, has evidently determined to convey to his readers the greatest possible amount of knowledge in the fewest possible words, and he has succeeded. We should imagine that the "Manual of Civil Engineering" is destined to become not only a monitor and guide to young engineers, but a friend and companion to those, who, having advanced beyond their student days, are building for themselves names and fames which shall be imperishable as the granite upon which they work.

Professor Rankine, unlike some of our southern civil engineers, has not attempted to instruct his audience in the matter of naval architecture, but has wisely left the question to those who, from long experience in wood and iron shipbuilding, have qualified themselves for the task of instruction therein.

We know not why we should withhold the information, frequently important in such cases, that the cost of the "Manual" is 16s.

NOTES ON THE INTERNATIONAL EXHIBITION.

We have before had occasion to speak favourably of the interest shown by the colonists of Australia in the coming Exhibition, and it is satisfactory now to state that the fruits of that interest are on their way to these shores. After preliminary exhibition at Melbourne and at Sydney, the various articles intended for transmission to the Industrial Palace of 1862, were, about the last week of the past year, we learn, all shipped for England, and are consequently now, it may reasonably be supposed, not far from our coasts. Possibly one of the most attractive features in the Australian collection—as it will be the most extensive—will be found in a certain pyramid gilt with gold. The object of this contrivance is to convey to the beholder at one view a tangible idea—if that term be admissible—of the quantity of gold which the auriferous fields of Australia have yielded since the first discovery of the precious material in 1851. It is a fact that the mind however trained to the study of large numbers, finds a difficulty in realising their actual magnitude, and it is only by the use of some familiar illustration, strong and striking, that truthful impressions in regard to them are conveyed.

It is easy enough to assert, and statistical evidence will readily sustain the assertion, that within the space of the ten years, which form the golden age of Australia, 800 tons of gold have been extracted from its soil and mines. Those who are familiar with tons of merchandise of any kind, will perhaps form some indistinct notion of the bulk which those 800 tons of dense metal would form if cast into a solid block, but without close calculation they would probably err greatly. Then if we say—Oh! taking the 800 tons to be worth in round numbers, £4 per ounce, we have in actual value, £104,649,728. This declaration helps but little to a comprehension of the extent of the mass of gold. Such were some of the considerations which induced the construction of the golden pyramid now on its way to Kensington. To Mr. Knight, of Melbourne, belongs the merit of conceiving and making the pyramid; and that gentleman intends, we believe, visiting London during the time of its exhibition, for the purpose of explaining it, and some gold-extracting appurtenances which will figure beside it, in the Victorian court of the Great Show.

The pyramid which will thus have the merit of representing in a condensed form all the stray nuggets and quartz yieldings of the Australian gold-fields, is forty-four feet six inches in height, and measures at its base ten feet square. On the four sides of the structure statistical returns are engraved, illustrative of the growth and progress of the colony; and over its entire surface *fac similes* of the most renowned nuggets are scattered. In as close contiguity to the great golden pyramid as the arrangement of the building will permit, will be placed some veritable blocks of quartz, and a crushing battery of twelve head of stamps for compelling the said blocks to yield their rich fruits. It is probable that at intervals this machinery, which will be accompanied by other fitments and appliances, such as are used subsequently to the crushing operations, will be put in motion for the information or amusement of visitors.

It is understood, moreover, that an artificial mine, intended to illustrate the character of Australian gold reefs, and also models explanatory of the alluvial workings, will be constructed by Mr. Knight, if such an arrangement be compatible with the views of the Commissioners. The Victorian Court will not, however, be entirely monopolised by gold and its accessories—far from it. The display of specimens of vegetable and mineral produce generally, will, unless we are much misinformed, be of surpassing interest to the scientific section of visitors to the International Exhibition. Of the variety of woods indigenous to the colony, and of their adaptability to ornamental and building purposes, we have before spoken, and these will all have representatives at Kensington. In the Mineral branch will figure, antimony, iron, coal, lignite, kaolin, rock-salt, limestone, tin ore, gold, silver, and copper, associated in the same vein of quartz; marble, granite, building stone of every variety of texture, and colour; blue and green carbonates of copper gypsum, &c., &c.

Precious stones of all varieties, as yet found in Australia, will be exhibited in a case of native wood. A raised map of the colony, so far as actual survey has enabled it to be constructed, will be exhibited in juxtaposition with the productions of which we have spoken, and this will convey to intending emigrants clearer notions of the physical conformation of Australia than any written description thereof. Of cereal products the Australian Court will present a rather meagre show, but of preserved meats, wine, ale, fish, &c., there will be abundant samples. Of leather and leather work, as might be supposed, the display will be worthy a place where the raw materials for the tanner, the currier, and the sadler, are produced in rich abundance. Agricultural implements, ballast trucks, models of bridges, puddling machines, will go to make the mechanical department respectable, whilst in the regions of Art, there will be photographs and sketches. Native weapons of war, baskets of sea-weed, cases of snakes and birds, and a miscellaneous collection of minor curiosities, will make up the sum of the Victorian collection at the Great Exhibition.

New South Wales and the new and flourishing colony of Queensland, will be fairly and fully represented also, and take it all in all, England will have no reason to be ashamed of her offspring at the antipodes.

When it was decided by the Royal Commissioners to form a military class in the International Exhibition of 1862, they requested the Secretary of State for War to nominate a committee to conduct the details. Lord Herbert referred the communication to the Council of the United Service Institution, and requested them to undertake the duties. A committee was accordingly appointed, composed of members of the institution. A naval committee was also appointed, and both these committees have held their sittings in the council room of that institution.

All the fastenings, such as nuts, bolts, tie-rods couplings, stay-rods, &c., for the Exhibition, are furnished by the patent nut and bolt company, Birmingham, the premises of the late firm of Fox, Henderson, and Co., contractors for the Exhibition building of 1851. These works are now in the possession of Messrs. Watkins and Keen, the former of whom came to this country from the United States about six years ago, bringing with him inventions for the manufacture of nuts, bolts, screws, rivets, &c.

The London correspondent of the *Richmond Examiner* says, perhaps I may be excused in informing the public, through you, that I have secured 1,600 square feet of space in the agricultural department of the Great International Exhibition in 1862, in London, and 400 square feet in the mineral and geological department, in which the rare and almost unparalleled agricultural and mineral resources of the South may find a representation. In the absence of a national recognition, I was compelled to secure this space in my own individual name, but it was done for and in behalf of the Confederacy. Our Commissioners in London attach great importance to a fair exhibition in these special departments.

SICKNESS AND MORTALITY IN LARGE TOWNS,

On the 4th of July last a paper was read at the Literary and Philosophical Society of Manchester, "On the Causes of Sickness and Mortality in the Manufacturing Towns of the North-West of England," by Dr. C. J. Shearman, of Sheffield, communicated by Dr. R. Angus Smith, F.R.S.

Previously to any examination of the disturbing causes of vitality, the proportion of age to the whole population should be ascertained for town and country districts; for under all circumstances, favourable or otherwise, age of an individual determines to a great extent the kind of sickness and the consequent mortality. In the towns of this part of England there are up to 15 years of age *less*, from 15 to 55 *more*, from 55 upwards *less* than in the adjacent country. Hence one of two evils results—either that towns kill young people and old fast—or middle age is imported.

As to the feeding of town population, an average of 6 per cent. is imported from purely country districts of those under 20 years of age; and of 26 per cent over 20 years. This constitution of replenishment of towns, associated with what is subsequently shown, *large mortality at early ages*, leads to the view that considerable drafts from the country from 15 years upwards are made by towns, and which latter are responsible for their health.

With the exception of infantile diseases, those of 15 to 55 years of age are the most fatal, and towns present a large field for the operation of disease at that age. The diseases of infancy and childhood are in a great degree infectious. Hence *density* of population would be considered a great element of mischief at those periods; but small pox, scarlet fever, and some others, more infectious than others present a less increase of mortality than measles over that of the country. The same law will apply to fever, influenza, and others at a later age—density and infection do not obey the same law of proportionate increase: neither will Dr. Farr's formula, for mortality increasing according to a certain root of the density, apply to provincial towns.

Imprudent and early marriage, and inebriety, have a certain value in the production of town mortality, but only to a slight extent, especially as to the former; the latter evil is not productive of so great an increase in the direct disease consequent upon it as materially to elevate town mortality over that of the country.

Atmospheric causes, those from malarious mischief, in this Paper are not entered upon to any extent: they have a variable value, which is balanced to a great extent by the higher rate of income and consequent improvement of sustenance.

The centralising system of this century is in itself not, therefore, it would appear, a great bane to the country; and yet towns kill considerably greater numbers of people than the country. There is an element of destruction which sanitary movements have overshadowed—viz., "The special influence of occupation."

In this abstract, to simplify as much as possible, the town population is divided into groups: one-fifth consists of certain occupations not peculiar to towns, but common to the present state of society, viz., *out-door heavy occupations.* This class is amenable to the worst influence of town life, and without the advantage of high wages and consequent choice of abode and addenda to the necessities of life—its mortality in towns is yet only 17·5 in the 1,000, the lowest mortality of the kingdom being 15 in the 1,000. The other four-fifths consists mainly of the skilled operative and commercial and professional classes. The mortality of this section is caused by the skilled workers, and mostly so when constrained position is requisite. One main object of the paper is to draw attention to this special element of town mortality, the alteration in the normal proportion of respiration to circulation of the blood appearing to be the turning point from health to disease. This portion of the subject cannot be entered into without considerable detail, given in the Paper itself. One point appears to be prominent, viz., that in the endeavour to ventilate, cleanse, drain, and distribute our town population, the necessary employment to earn a *livelihood* in towns has carried with it the seeds of disease and death, and escaped to a great extent the notice of those able and philanthropic people who have devoted their energies to the best mode of increasing the health and prosperity of their fellow-labourers.

A NEW SOURCE OF INDIGO.

Mr. Spence recently brought under the notice of the Manchester Literary and Philosophical Society a ball of the dried leaves and stems of a plant imported from the west coast of Africa, in the kingdom of Dahomey. This plant, which grows spontaneously in great abundance, is used by the natives in dyeing cloth, to which it is said to give a good but not very permanent blue colour.

The parties who have imported these leaves are Messrs. Burnet and Thwaites, of Manchester, and they state that two years ago the sample had been examined without any result. About two months ago, Mr. Spence gave Dr. E. Schunck, F.R.S., a portion of them, he kindly undertaking to see whether they contained indigo. Circumstances prevented Dr. Schunck, until very lately, from entering upon the investigation, and the importers being anxious as to the matter, Mr. Spence, assisted by Mr. Bottomley, undertook the investigation, and at once found that the plant contained indigo perfectly formed, and which was easily extracted by the usual modes of deoxidation and solution, the indigo being then precipitated pure and of a beautiful deep coppery shade. The only question now was to its containing indigo in quantity sufficient to render the importation profitable. The solution of this question being partly one of chemical manufacture, has been undertaken by Mr. R. Rumney, who is to operate on a large quantity, so as to get results of commercial value.

Mr. Spence was chiefly induced to bring this subject before the Society from the fact that a new source of indigo at the present time would be a matter of great importance to trade, the growth of the article in India being, from peculiar causes, rather on the decline. Dr. Schunck corroborated Mr. Spence's statements so far as that he found indigo fully formed existing in the specimens submitted to him; he had not had time as yet to ascertain what quantity of that body they contained. Mr. Mosley stated that it had been known for some time that the indigo plant grows wild in many parts of the west coast of Africa; he believed it would be of great importance at present if a new source of indigo could be found, as the Indian manufacture seemed to be declining. He believed the manufacture had been attempted in Africa, but had not succeeded.

THE ARTESIAN WELL OF THE ROYAL HORTICULTURAL SOCIETY.

When the plan of the garden of the Royal Horticultural society was first settled, and ponds, basins, canals, cascade, and fountains resolved upon, the question still remained, how the vast amount of water required for these purposes was to be supplied. It was found that, there could be no question as to which was the most expedient course, if it were certain that an Artesian well could be sunk for the sum at which it was estimated, that after it was finished it would produce the requisite quantity of water, and that the water so obtained would be suitable for the purposes of the garden. These risks seemed so formidable, that the Council might perhaps have declined encountering them, had not Messrs. Easton, Amos, & Sons, their hydraulic engineers, relieved them from their embarrassment by undertaking to sink the well on the principle of "no cure no pay." These gentlemen were so confident of success, that they not only undertook to sink the well to the required depth (400 feet) for the estimated price, but also guaranteed a supply of 75 gallons of water per minute. This determined the Council to undertake the work.

The work has now been completed, the well bored, and the decision of the Council, as well as the confidence of the engineers, has been justified by the result. Not only has the well been sunk at the estimated cost, and water been found at the expected depth, but it has been found of the purest and softest quality, and in such abundance, that, instead of supplying merely from 100,000 to 110,000 gallons in the 24 hours (the quantity stipulated for), it can readily supply a million gallons in that time, if larger pumps and more powerful engines were employed. The total depth sunk and bored is 401 feet—a well having been sunk to the depth of 226 feet, and a bore thereafter carried down 175 feet farther.

In the Trafalgar-square well, which was sunk in 1844, the pumping of 100 gallons a minute for 48 hours lowered its surface 4 feet, and it has ever since maintained the same standing level, varying only with the season. The society's well has only been lowered 16 inches by the same amount of pumping. The supply of the Society's well may, therefore, be fairly reckoned to be many times larger than that from the Trafalgar-square well, which previously was the largest in London. It will also be observed, that the standing-level of the Society's well is in point of fact actually considerably higher than that of the Trafalgar-square. This may, perhaps, be accounted for by the greater number of other Artesian wells sunk to the eastward of the latter, and possibly also by its being nearer to the outlet of the water.

The fellows of the Society may, therefore, congratulate themselves on possessing the finest well in the Metropolis. To form some idea of what such a phrase really implies, and of the importance of their possession, we must calculate what the supply which could be furnished would bring if it could be sold at the price charged by the Water Companies, viz. 6*d*. per thousand gallons.

Assuming that the wel at Kensington can furnish 1,000,000 gallons per day, and that it could be utilised, it would, on the same rates, and allowing for larger engines to work it, yield a yearly return of 7,500*l*. in the gross to the Society, or above 5,500*l*. net profit.

THE ANTIQUITY OF MAN.

The lecture recently delivered by Professor Huxley, at the Royal Institution, on the Fossil remains of man was bold, comprehensive, and eloquent. After glancing at the different forms of human heads in different parts the world the professor said:—Passing to the old world, accurate knowledge was confined in Europe. Archæology shows us beyond the middle ages and beyond the epoch of the Romans, another group, a long-headed people of Germanic origin, well acquainted with the use of iron. Beyond this came another race of greater antiquity, of smaller stature, and in general character more like the Hindu, who worked in bronze. Beyond this, again, archæologists produce another race, neither characterised by manufactures of iron nor of bronze, but forming their weapons and tools of the hardest stone. These stone implements are found in their tumuli, with the skeletons of the race who made them. The buried warrior is found sitting upright, with his heavy stone axe beside him, ready to meet, in the "fields of happiness," his companions or his enemies face to face. The crania of these people were rounder than those of the iron or of the bronze age; and some of them had flat foreheads and strong ridges over the eyes, with large but not prognathic jaws. Such were the skulls of the people of the stone epoch. If it be asked, how far distant was this stone epoch in time, it would be difficult to give the precise date beyond the birth of history, and yet there is a mode by which the period can be given with considerable comparative accuracy.

Denmark is covered by numerous peat-bogs, often very deep. In digging into these, trees, which have fallen in, are often met with—great beech trees, such as are now the glory of the country. Digging deeper, we come to the relics of another forest—a forest of oake, large, too, in size, with their tops lying towards the centre of the bog. Cutting down again still lower, we meet with yet another buried forest, neither of beach, nor of oak, but of pine—great trees of 3 or 4 feet in diameter, and with the straightest trunks, showing themselves thus of forest growth. In the memory of man there have been no other trees than beech. The climate of the country, then, must have changed since the ancient growth of oake; it must have changed again since the indigenous growth of the pine forests.

Men of the iron age are found in the peat; beneath the oak forest men of the bronze epoch; and from beneath the pines the stone implements of those of the stone age are brought to light. Still lower, in the lowest peat, there are no weapons, no traces of man at all. What is meant by this chronicle, not of time, but of facts? How vast must be its remoteness if measured by ordinary human standards? But so far as we have yet been speaking, the physical geography of the earth remained like to what it is, with rivers running in their present channels, sea coasts bounding seas of like extent, while the dry land of to day was dry land then. The hill-caves, too, were high and dry, without water flowing through them.

By a singular accident we have gained a knowledge of the habits of these stone-workers, and from their refuse bone-heaps we know that in Denmark they hunted the Aurochs and the *Bos primigenius.* We know that these "stone" people built huts on piles in the lakes of Switzerland, what implements they had, what weapons, what food. The animals which supplied the last were much the same as now, except the *Bos urus* and *Bos primigenius.*

Beyond all the traces of the stone age, there was an utterly different period—a time when what is now sea and sea-shore held different relations, when what was forest and much of what is now dry land was under water, when other rivers flowed in other channels, and have left their deposits now raised a hundred feet above the flow of existing rivers—a time when the physical features of the country were altogether different. And when we arrive at this age, we find the whole fauna of the region to be largely changed.

Mammoths and rhinoceroses swarmed over the land, just as badgers and weasels do now, and their bones, with those of the cave-bears and hyænas, have been washed down in the *débris* of the soil and preserved. Where was man in that age? Until within a few years the answer would have been, "Not there." Preconceived belief was so strong that, although the evidence existed thirty years ago, his presence was ignored. But of late the proofs have so rapidly accumulated as to break down all the barriers of prejudice, and the evidence that man was associated with the *Bos primigenius*, the cave-bear, and tichorhine rhinoceros, by the discovery, within the last few years, of such numbers of his worked flint implements,—not ground to a face or edge, but simply chipped into form,—in proximity to the bones of those great beasts, has been so well authenticated that no instructed person now doubts for one moment the contemporaneity of man with the mammoths.

HIGGINS AND WHITWORTH'S SPINNING AND DOUBLING MACHINERY.

FIG. 1.

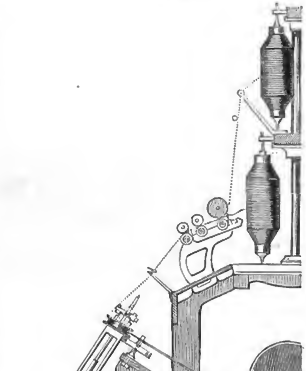
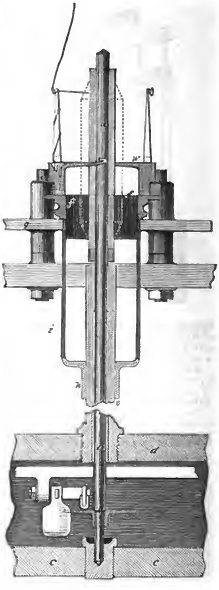


FIG. 2.



HIGGINS & WHITWORTH'S SPINNING AND DOUBLING MACHINERY.

The above engraving represents a portion of an invention recently patented by Messrs. Higgins and Whitworth, of Salford; Fig. 1 shows a vertical section of part of a throstle, and Fig. 2 a detached view of a spindle and its immediate appendages upon a larger scale.

The invention refers to those machines in which a revolving ring flyer is employed, bearing by its periphery against supporting rollers, and through which ring flyer the cop or bobbin of material passes, and consists in supporting such ring flyer by extending it downward and there adapting a bearing, and for this bearing is used a tube attached to the copping rail, which tube also supports the spindle by which the bobbin is carried, or upon which the cop is formed, or, instead of the tube above referred to, a bearing is formed for the ring flyer by means of a stationary rail, through which the said tube passes, or a similar bearing is placed above the ring instead of beneath it, as above mentioned.

The spindle *a*, is mounted at bottom in a footstep attached to a rail *c*; to another rail *d* is fixed a tube *e*, through which the spindle passes, at *f* is the ring flyer, the periphery of which bears against two rollers *g*, mounted upon axes carried by the framework of the machine. Upon the ring flyer are mounted guides *h*, through one of which the material to be spun or doubled passes, and from thence to the spindle, if a cop thereon is to formed, or on to a bobbing if desired, as shewn; the ring flyer extends downward and is furnished with arms *i*, which terminate in a boss *k*, which bears upon the tube *e*, and caused to revolve by a band proceeding from the usual speed drum, as clearly shewn at Fig. 1. The flange formed upon the ring flyer keeps it from sliding down the tube *e*. The two rails *c*, *d*, are in one piece, and are carried by sliding brackets (one of which is shewn at *o*) furnished with racks *p*, acted upon by pinions *q*; these pinions being caused to revolve by any usual copping arrangement, will cause the spindle *a* and tube *e* to move upward and downward so as to present different portions of the spindle or bobbin to the point of delivery of the material, during which operation the tube *e* slides within the boss *k*, and forms a continual bearing for the ring flyer.

ON SUBMARINE OPERATIONS.

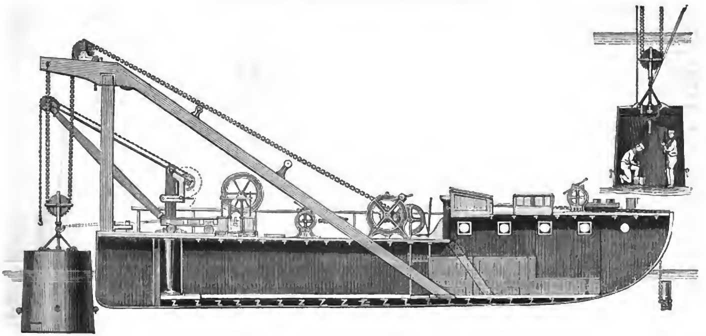
The following paper "On Submarine Operations," was read by Mr. Andrew Brown, at the Scottish Shipbuilders' Association, Jan. 6th 1862. Robert Barclay, Esq., President, in the Chair.

The importance of submarine operations in the construction and maintenance of harbours, cutting and blasting rocks, raising sunk vessels, and other submerged works, leads us to notice a few of the improvements which have been from time to time adopted in diving.

The invention of the diving-bell in Europe is generally assigned to the sixteenth century, and the oldest information we have respecting the use of the bell is described by Lord Bacon to have been in 1538 at Toledo, when two men went down in a large inverted kettle, and came up again without being wetted. This experiment caused a number of people to gather to see it.

The diving-bell was employed in undertakings of importance about the latter part of the seventeenth century, when one of the vessels of the

ON SUBMARINE OPERATIONS.



Spanish Armada, which was sunk near the Island of Mull, was examined by a diver, who went down with a leather tube. An attempt was made with a diving-bell, and some guns raised.

A ship carpenter, named William Phipps, formed a plan, got diving tackle, and raised a large sum of money from a Spanish wreck sunk near the Bahamas.

One of the oldest kinds of diving apparatus was a square box of timber, bound with iron, made perfectly air and water-tight on the sides and top, the bottom open, and weights to sink it. We need scarcely say that by gradually lowering such a vessel into the water the air cannot escape, but will be compressed by the weight of the column of water above it. For instance, should the bell be lowered thirty feet, the air in the bell would be compressed into half its original bulk or volume. This condensation of the air does not materially interfere with the respiration, provided the descent of the bell be gradual, as the air insinuates itself into the cavities of the body, and equalizes the pressure. The increased pressure causes a slight pain in the ears, until the air, finding its way by the mouth and nostrils, restores the equilibrium. But while the condensation of the air in the bell does not make it unfit for breathing, it would soon become vitiated by repeated respiration if means were not taken to renew the air.

Dr. Halley supplied his bell with fresh air by sinking casks weighted with lead, each cask having a hole in the bottom and a leather pipe attached to an opening in top. The end of the hose was kept below the cask in its descent, and when down, the pipe was taken inside the bell, and the air pressed in by the water. Halley removed the principal difficulty attending the diving-bell, and advised its use in depths where it had been considered impossible.

The next improvement was by Martin Triewald. His bell had a suspended stage for men to stand on, with their heads only in the bell; the air was cooler in the bottom. He used convex glasses to admit light from the top.

Another kind of bell was constructed of timber by Mr. Spalding, who used a balance-weight suspended by a rope over pulleys from the centre of the bell, which could be suspended at any depth, by pulling the rope when the weight rested on the bottom, and the workmen in the bell could lower themselves at pleasure.

Smeaton's first bell was an oblong wooden box, and was supplied with air by a force-pump fixed to the top of the bell above the water; and after this he got a cast iron one for repairing harbours, and the air was supplied through a flexible tube by a force-pump in a boat or barge.

Rennie improved the apparatus for moving the bell in any direction.

In another apparatus by Santier, a communication is maintained between the divers and the surface by means of a tube large enough to admit a man to pass; the tube being furnished with sliding air-tight doors, so as to allow only a certain quantity of compressed air to escape. When the men were ascending, the weight of this bell was regulated by proportions of air and water in an external chamber.

In this machine there is the risk of the men coming up too fast, and not allowing sufficient time for the compressed air in their bodies to expand, and some serious accidents have taken place on this account.

One of the latest improvements upon the old diving-bell is an American invention, called the "Nautilus Machine." Its form may be varied,—one kind has a spherical top, with conical ends, and having separate chambers for air. Water is admitted into some of the cavities to serve as ballast, and cause the machine to sink. A floating barge carries a steam boiler, air reservoir, and pumps, to keep up a constant pressure. When descending, air is taken from the reservoir, and when at the proper depth the door is withdrawn from the bottom, ready for operation. Great depths may be attained by this kind of machine, as the men below can regulate the air according to their wants, by means of stop-cocks or valves, taking small additions to the pressure until the amount of deep water is obtained, this being more safe than having air all at once, as the pores of the skin filled with ordinary atmosphere, will expand and be filled with the more condensed air. If this change is gradual little inconvenience is felt; but if the change is sudden it is very hurtful to the diver, and more than he can safely bear when oft repeated. After the equilibrium is restored in the system of the diver he will move and breathe as freely as before. An increased state of vitality is the result, owing to a greater quantity of oxygen, contained in the same volume of air at each breath or inhalation. Relieving the pressure in the same gradual way, no difficulty is felt in rising to the surface.

The diving dress next claims our attention, as it has been extensively used in many operation where the bell would not answer. For working at sterns of ships, or where the divers require to shift from place to place, it is more useful; but when we wish to lift heavy stones or other material, the advantage of having a means of raising them is gained in the bell; and in some rivers a diver in a dress would not be able to see to work on account of the muddiness of the water. In the bell the men are comfortable, and have light from candles.

The dress of the divers engaged at the Westminster bridge consists of a suit of flannel, then a waterproof dress, which is like a jacket and trousers in one, and which hooks on to the breastplate, with an india rubber binding, fastened by screws; elastic bands tightly grip the wrists; the soles of the shoes or boots are covered with lead, and weigh from eighteen to twenty pounds each. The diver carries also a weight on his back and one on his breast, about half a hundred weight each. The helmet, with the air pipes and eyes, is of considerable weight. The divers have sometimes been for three hours under water, and state that during the winter they feel the cold very much in their hands, as the circulation of the blood is stopped: they feel it intensely when they come up, and when the blood begins again to flow.

The accompanying engraving is a longitudinal section of a barge built at London Works, Renfrew, for the Clyde Trustees, from the designs by Mr. Duncan, their engineer. The hull is of iron, 56 feet in length × 23 feet breadth of beam × 7 feet deep. The centre of the boat is used as a store-room for the various tools, &c., required in their operations. The fore part is fitted as a cabin, and contains fourteen sleeping berths for workmen.

The bell is of cast iron, 6 feet 6 inches long × 6 feet wide × 6 feet 6 inches high, and, together with the top gear, weighs nearly ten tons. It is seated for four men, and fitted with hooks and shelves for holding tools; two rings are suspended from the roof for lifting stones, &c. The valve in crown has a spiral spring, to close it at every stroke of the pump and prevent the air from escaping, in the event of the pipe being cut or damaged. The air-pumps, cylinders, pistons, admission and discharge valves, are all of gun metal, and the openings for admission of air are protected by fine wire gratings, to prevent dirt from getting in. The gearing for working the pumps is fitted with double levers and crank handles, fly-wheel, crank, and connecting rods. The pumps require two men to work them when the bell is in less than 15 feet water. The conducting pipe which supplies the air is of vulcanized india rubber, covered with strong canvas, to protect it from injury. Nine men are required to work efficiently the barge and machinery. The main crab for hoisting the bell is fitted with a strong malleable iron ratchet on the barrel, and having three strong pauls for holding when the bell is suspended. The crab is securely fixed to oak sleepers and bolted to deck beams. A small crane is used for lifting stones, &c., alongside of the bell, up to 4 tons weight. The framing for suspending the bell is formed that the suspending chain can be shifted out or in, as the various operations may require. When the bell is wanted on board the carriage is run out on the brackets, and drawn in by a tackle fastened to the small stern winch. The frame carries a knocker for signalling to and from the divers. There are two cast iron mooring heads used for raising piles, by fastening, at low water, a chain round each head, leading it over the bow, and attaching it to two or three piles, running out the bell as far as possible, and fastening a punt, loaded with stones, at the stern. As the tide rises, either the piles must be raised or the barge be drawn under the water, the chains break, or be pulled rigid like a bar. I have seen the links of two 1-inch chains pulled perfectly close and straight.

GERMAN YEAST AND BREAD MAKING.

(Concluded from page 83.)

It follows, from what I have stated, that there are yet two points to be overcome,—the one comprehending complete alterations in the existing excise laws; for although the permission lately given, and already referred to, is a step in the right direction, still it requires to go further to be practically serviceable; and the other—supposing this first difficulty to be set aside—is the consideration of continuously preparing solid yeast from uniform healthy and sound malt and grain, with the view of copying more closely the German method of producing systematically a good and uniform yeast. This latter point is not easily settled or arranged, because, though a practical question, it is one which even a distiller can scarcely solve; as to what will be the relative cost in using fresh malt and grain of a known standard and quality, without reference to its market value, compared with the price at which he could buy other cereals capable of producing an equal quantity of spirit, but little or no yeast. If the grain market never varied, or was certain to remain moderate, there would be no difficulty in making such an estimate; as on the other hand, the average value of German yeast throughout the year could very easily be calculated; but the grain-markets fluctuate so much, from so many different causes, that he would be an unusually wise man who could predict the prices at which wheat, barley, and corn, would be sold for twelve consecutive months. It is quite true, that at certain seasons of the year a good deal of solid yeast might be prepared of excellent quality and strength, even under present excise laws, strict as they are, and though limited in extent as to removal of the raw material, were all distillers to unite in giving what they could; but the German makers are so jealous of their own interest, from having had now for so many years an entire monopoly of this trade, that it is a well-known fact, from the existence of a combination among them, that any party attempting to traffic in other than Dutch or German make would be refused supplies; and thus suffer loss and great inconvenience, unless they had Scotch barm steadily to sell and use all the year round. Hence, nearly all the offers made for contracts extended to not less than twelve months. The awkwardness of the chance of failure, from the change of grain giving no yeast, will occur to the minds of all, when it is remembered, that bakers who had once begun to use this solid material, would naturally expect steady and regular supplies, and, if disappointed, might be the means of putting many families and individuals in the strange and unpleasant position of having no bread.

When I laid my former communication before you, I made a special reference to the new system of baking bread under the patented process of Dr. Dauglish, which, as is now pretty well known, is intended to supersede the ordinary panary fermentation, by substituting mechanical admixture of carbonic acid gas. In speaking of this mode of manufacture, I expressed a doubt, that although a large bakery had been established, in order that this new system might be fairly tested, I yet feared that, when fairly in practical operation, the rapid escape of the gas from the dough would be so instantaneous as to produce what all dislike, a flat and sad loaf. I knew this had been the case when tried some time previously; and there really appeared to be so much difficulty in finding a remedy, that I fancied it was insurmountable. Having occasion to be in London about a fortnight ago, and feeling considerable interest in the progress of this manufacture, I visited the Aerated Bread Establishment of Messrs. Peek, Frean and Co., at Bermondsey, and will give very shortly the impressions made by what passed under my observation. Furnished with a note of introduction to one of the partners, I stated my object, and was at once received with the greatest cordiality. My first call was in the forenoon, but I learned that the making of bread commenced every evening at six o'clock, and was invited to return at that hour and witness the whole operation. I did so, and found everything in excellent order; and that so far, the attempt to bake bread by the aerated process had been most successful, six machines being constantly at work.

Bread and biscuit making are conducted in two large lofty airy apartments. There is no dust, plenty of room, excellent ventilation, and but for the night work, the occupation might be fairly considered as one of the most healthy in London. The carbonic acid gas is generated outside the building, and is usually prepared during the day from common chalk, sulphuric acid, and water. The gas thus formed is stored up in cisterns or tanks ready for use when required. Each machine has a metallic spherical vessel, which is known as the mixer, and is made of size sufficient to hold an ordinary sack of flour when treated with the requisite quantity of water and gas. There is a large circular aperture at the top of this vessel through which the flour is sent by a large tube or shoot from the warehouse above; the termination of which being made of strong cloth is easily set aside to admit of the orifice being thoroughly closed. Before this is done, however, the proper quantity of salt is added, when, by means of a screw worked by a hand-lever, the head is made perfectly tight, so as to resist pressure from within or the action of the air from without. By a very simple contrivance, steam-power is used to pump out all the atmospheric air from this mixer so as to produce a vacuum, which is known by a gauge or indicator. This being done, a powerful stop-cock is turned to keep the mixer in proper condition, and the same steam-power is as quickly made use of to pump up 17 gallons of water into a metallic cylinder, placed close to, and in connection with, the mixer, which is no sooner done than the power of the engine is employed to force the carbonic acid gas through the water, and as a communication is now opened between this receiver and the mixer, the gas passes through the water, and rushing in, supplies the vacuum in the vessel where the flour and salt are already lying. The forcing of gas in this manner is continued until the pressure in the receiver and mixer is equal, and reaches about 100 lb. on every square inch. This, of course, is also shown by a plain indicator; and when the proper amount of pressure has been gained, the aerated water itself is allowed, by turning another stop-cock, to run into the mixer, and immediately the same steam-power is directed to incorporating the water, gas, flour, and salt so as to produce dough. The means employed to do this are very simple. A revolving bar of iron, having projecting arms, with alternate cross-heads, is moved with considerable rapidity, so that in a few minutes the dough is prepared and ready for the oven. It must, however, be observed that the pressure continues to be exerted until all the dough has been expelled from the mixer, and this is done very easily. A boy turns the handle intended for the escape of the dough, and, in doing so, presents a small orifice through which it is forced with such power that on entering a large tin tube made of a suitable size, it fills the whole space, and being still farther pushed forward, is allowed to fall into a dish prepared to receive it, and is then cut off with a knife. Thus one boy works the key to permit the dough to escape, another holds up a wooden tray made to hold exactly 2 lbs., cuts off the dough, hands it to a third boy, who weighs it, tray and all, passing it to a fourth boy, who transfers the small loaf into a tin pan ready to be placed in the oven. This goes on with more rapidity than I can describe; but it may be curious to know the precise time occupied in the whole operation.

The flour and salt are placed in the mixer in two minutes, the air is exhausted from this vessel in four, carbonic acid gas is pumped in ten, the materials are all mixed, and the dough perfectly formed in eight. Thus in twenty-four minutes we have a sack of flour converted into dough suitable for placing in the oven; while if we allow one hour for the time the bread remains there to be fired, we have some idea of the very rapid manner in which bread may be made by this process. I may here draw attention to the fact that in all the various stages the hand never touches the dough until it has become a loaf and is ready for use. I was much struck with the kind of ovens in use at this manufactory. They are named *travelling ovens*, and are so constructed that the floor of each shall be formed of movable iron plates, of such a size as will hold twelve loaves in a row, while the length is so considerable that each will contain the produce of two sacks of flour, or about 400 half-quartern loaves. The movement of the floor is so regulated that from the time the dough is placed on the first set until it passes the whole length of the oven one hour elapses, and this gives the proper time for the bread to be baked, so that while the loaves are tumbling out baked at one end, there is a constant supply of fresh dough put in at the other, and thus a constant circulation is kept up as long as the dough continues to be made. As supplementary to those travelling, there are perpetual ovens also in use. These receive this appellation in consequence of the fire being placed at the back, and are thus fed and supplied with coal, without in any way disturbing what may be in the oven. Now I witnessed the dough, after being weighed, carried to these ovens and placed there, just as is customary in the ordinary bakehouse. Two machines are generally placed together, and the staff required to work these consists of one foreman, two oven men, and nine boys. These will work about two sacks of flour every hour. At present the consumpt is forty sacks every night, but it is said they were at the time I made my visit making less than the average, and they expected soon to be converting double the number of sacks of flour per night into bread. The first quantity would give roughly, as the making per night, 4,000 whole or 8,000 half loaves.

The bread produced by this process is very pleasant and sweet, and certainly approaches more nearly to that baked with German yeast than any I have seen. It must be evident from what has been stated, that the patent system just described is only admissible on the large scale, although, I believe, the patentee is sanguine, that even ordinary bakers may yet employ his apparatus, as he contemplates having them made of suc[illegible] a size, as will enable them to be worked by h[illegible]ed power. One objection by many to this bre[illegible] that it is still a shade higher in price th[illegible] cakings ordinary loaf, to the extent of from a far[illegible] le seven- a half-penny on each. It occurred to ls of the

Digitized by Google

with such rapidity of manufacture, the objectionable night-work might be got quit of altogether; and I said so, but was told that their customers would have new bread in the morning, and therefore they had to bake at night, make the bread ready early in the morning, pack into vans, and despatch these—to the number of fifteen—round the various districts requiring supplies, so as to be ready for early breakfast. Indeed, this is one of the reasons why the price of this bread is at present higher, viz., the great expense in sending it so far away after it has been prepared.

One difficulty still remains to be overcome in connection with the manufacture, and that is to get rid of sulphuric acid in the preparation of carbonic acid gas. This, the company are struggling to do, having the idea, that if the common chalk can only be heated to a sufficiently high temperature, chemical affinity will be overcome, and the gaseous compound set at liberty. The partners are sanguine of success, the only existing obstacle being the difficulty of getting materials of which to make retorts that will stand the excessive heat. If they accomplish this, there will be a saving of at least 3s. on each sack of flour.

Two remarks more, and I finish this part of my subject: and first, in consequence of the non-abstraction of any portion of starch to produce the fermentive action, so constantly followed in all our bakeries, it was imagined and believed, that there would be a positive saving of flour, to the extent of at least 10 per cent. This, I understood, was Dr. Dauglish's own idea. All very well in theory, but when reduced to practice found to be erroneous. The real saving—for that there is a saving is undoubted—amounts to 3, and actually never exceeds 3½ per cent.

The other remark is, that medical men are still somewhat divided in opinion regarding the merits of this new bread for general use. Some laud it very highly, and go the length of stating, that it will cure weak digestion, and thus give relief in all dyspeptic cases. Other allege and maintain, that it is not only indigestible, but that bad effects are sure to follow, in cases of weak or impaired digestion. Thus the famous Dr. Letheby has declared that all kinds of unfermented bread, Dr. Dauglish's among the number, are more or less liable to produce gastric derangement. Mr. Lobb, on the other hand, declares, that to some, fermented bread was all but poisonous, and that from personal experience the use of the aerated bread gave the most wholesome results. Dr. Lankester is much in favour of the new bread. Without pursuing this part of my subject farther, I may just observe, that it is not alone on this point that "*doctors differ;*" while doubtless for a time, and indeed as long as aerated bread is made, there will be found some high in its praise, while others will give a preference to the old loaf. The patent bread will certainly have one advantage, viz. it will never be sour, and be always uniform.

I fear I have exhausted your patience by the preceding remarks in connection with yeast and bread-making; but the real interest attached to any information connected with the manufacture of an article of such importance, not to any one community alone, but to the whole human race, must plead my apology. I would only add, that from the amount of success which has already attended Mr. Dauglish's patent for the production of bread, it would almost appear as if the appliances of chemical knowledge and mechanical skill, were about to create a favourable change in the production of what is correctly called the *staff of life*. With the probability of solid yeast being made in this country, capable of producing bread by fermentation in from one to two hours, and the Aerating machine turning out prepared dough in twenty-four minutes, what changes may not be fearlessly prognosticated! Iron in many cases, both on the Continent and at home, is now doing what the muscles of the arms and legs have been called upon for centuries to do, while steam power has been seized, and compelled to mix, manufacture, cut and even weigh dough suitable for bread. In all sincerity, let me express the hope, that ere long, by continued exertion and enterprise, such improvements will be effected in the mode of manufacturing our daily bread, that the knell of utter annihilation may be rung, for the removal of such miserable holes and dens, as we know to exist in many large cities and small towns, where men toil and work from early morning till far advanced in the afternoon, in places called bakehouses—as a rule, far below the surface of the ground, low-roofed, badly ventilated, and as badly lighted—gas burning most of the day—the air at a high temperature and otherwise vitiated, men are found at work, until too frequently the whole animal system receives a shock, too great for flesh and blood to stand; till at last many fall victims, or dwindle prematurely into such a state of health as precludes their following out any other avocation, thus leaving them too often dependent upon the charity of others. I do not say that the aerated bread system is to be a panacea for these evils, but I have often thought that, in the preparation of dough, much that is at present objectionable might be removed, labour lessened, and comparative health preserved, while I am convinced, that the production and use of German yeast, would be one step to the abandonment of night and Sabbath-day labour, as at present existing in our bakeries.

In conclusion, having now, I hope, satisfactorily shown that solid yeast CAN be prepared here, of as good quality in every respect as that imported from abroad; and having also referred to the difficulties in the way of at once entering upon its manufacture as an article of commerce, I may be allowed to say, that in the event of the Excise still more relaxing their laws, and allowing the distillers to remove all the yeast they can skim from their vats, and if it shall be found that the steady use of certain grain will afford a margin of profit to the manufacturer, then I have little doubt we shall very soon prevent large sums of money leaving this country, and find Scotland, already famous over the whole world for many of its manufactured articles, taking the lead in the production of a solid yeast of such quality and make as will not only give entire satisfaction to the present dealer, but also open up a new trade, by inducing many who have not hitherto used the article to test its merits for baking purposes, and become convinced of its superiority over the barm at present used.

METALLIC LUSTRE.

At a recent meeting of the Microscopical section of the Manchester Philosophical Society, a communication from Mr. A. G. Latham was read, upon the subject named for the evening's discussion, "On the cause of the metallic lustre on the wings of the Lepidoptera, both diurnal and nocturnal." Mr. Latham believed that the metallic lustre may be simply referred to the presence of a pigment in the substance of the wing, in some cases light-absorbing, and in others light-reflecting; all the scales seem equally adapted for reflecting the prismatic colours, consisting of three distinct membranous films, covered with minute irregularities. Mr. Latham sent to be exhibited a number of slides for illustration.

A communication was read from Mr. Dancer, in which he referred to a paper, read by Sir D. Brewster, at the last meeting of the British Association, containing the following remarks by Professor Dove:—"In every case where a surface appeared lustrous there was always a transparent, or transparent reflecting stratum of much intensity, through which we see another body; it is therefore externally reflected light in combination with internal reflected or dispersed light, whose combined action produced the idea of lustre. * * This effect we see produced when many watch glasses are placed in a heap, or when a plate of transparent mica or talc, when heated red hot, is separated into multitudes of thin layers, each of which, of inconceivable thinness, is found to be highly transparent, while the entire plate assumes the lustre of a plate of silver." Mr Dancer sent for exhibition several pieces of talc, which in places, by the action of the blowpipe, had been heated to redness; the films were thereby separated, and the raised or blistered portion gave a metallic lustre like silver.

Mr. W. C. Unwin believed that the metallic lustre was due not to pigment but to the reflection of light from internal surfaces of the scales through the transparent outer layer. The light so reflected appeared to be modified in two ways—by the ribs or striæ; it was dispersed by them so that the scales were lustrous at various angles, and it was also in some cases coloured by interference caused by them. Iridescence appeared to be also produced in some scales by the thinness of the laminæ through which the light was refracted causing interference. Mr. Unwin exhibited a number of specimens to illustrate his arguments.

Mr. Sidebotham observed that the metallic appearance was not due to any colouring matter in the scales, as chemical agents, which destroy the colouring scales, have no effect whatever on these metallic ones; he also mentioned a curious polarizing effect produced by crossing the metallic scales of Plusia bractea. Mr. Sidebotham exhibited the metallic scales from Plusia orichalcea, Plusia bractea, Plusia festucæ, Plusia concha, &c., illustrative of his remarks.

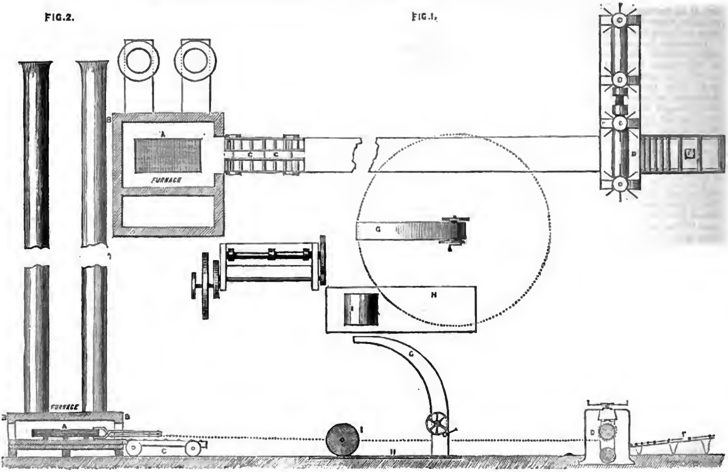
It was ultimately resolved that the discussion should be adjourned, so as to enable the proposer of the subject, and other gentleman not present to express their views.

PRESERVATION OF STONE.

At a recent meeting of the Architectural Association, Mr. A. H. Church read a paper "On the Preservation of Stone." The author treated the subject chiefly from a chemical point of view, describing, 1stly, the nature and causes of those injuries suffered by stone against which it is our object to guard. Under this division he spoke of the *weathering* of rocks and of the natural agents of destruction with which building stone has to contend, and also of the more rapid injurious influences of artificial origin. He showed how far the destructive actions of water, carbonic, sulphurous, and sulphuric acids, &c., were chemical and how far mechanical. In the second part of the paper the following principles were laid down as being likely, when carried into practice, of accomplishing the end in view:—1. Any process to be thoroughly effectual in arresting or preventing the decay of building stones must be easy of application, and moderate in cost. 2. It must render absorbent stone less porous, and at the same time counteract the influence of injurious bodies in the air. 3. It must effect the consolidation of stones in which the particles are loosely aggregated, and it must harden stones easily abraded by slight mechanical means. 4. The colour, surface, and texture of the stone must not be materially altered by the process. 5. The protective material must not be a mere film, but must penetrate to some depth; nor must it be liable to such contraction of the surface as shall cause a separation of particles from the stone. 6. The protective material must be less soluble in water, and less amenable to injurious atmospheric influences than the original materials of the stone. 7. No soluble salt, especially no effervescent or crystallising salt must remain in the stone as one of the products of the protective process. The author, in treating thirdly of actual processes, arranged them in classes, and pointed out, how far most of them were from fulfilling the necessary conditions of success. Imagine the absurdity of applying to stone as a preservative material a preparation like starch paste, itself undergoing in the course of a few days a most offensive decomposition. Such a plan with many others less palpably, but not less really, unsuitable, has actually been proposed. Lastly, some of the results of an examination, chemical, physical, and microscopical, into the results of several of these processes were detailed. One of the most curious of these results was the effect

MANUFACTURE OF ARMOUR PLATES.

FIG. 2. FIG. 1.



produced on stones by the efflorescence of sulphate of soda or sulphate of magnesia upon their surface. The formation of such salts is actually favoured by some of the so-called preservative processes; and it is remarkable to note upon the summit of each hair-like crystal a minute fragment of stone torn off and carried forward by the force of the crystallization. Another singular phenomenon was described as occurring when a strong solution of silica in water is applied to chalk or any soft limestone. The silica glutinizes on the surface, the film thus formed separated into small scales, and, as these fall off, it will be noticed that their under surfaces are covered with minute adherent particles of the stone or chalk.

MANUFACTURE OF ARMOUR PLATES.*

Two methods of producing large masses of wrought iron have been in use; the first by the process of building up under the steam hammer, and the second by building up under the rolls. Under the steam hammer, the plate is produced by welding together lumps or masses of scrap iron, each mass of scrap being added and welded to the end of the plate, until it reaches the required length. Plates made in this way have been seriously objected to on account of their brittleness; and it is reasonable to suppose that this mode of manufacture is somewhat likely to induce brittleness. There can hardly be any continuity of fibre in a plate forged from masses of scrap iron, perhaps, of different qualities, each at different heats; the nature of the weld and its form, and the repeated cooling and re-heating of the plate, are also adverse to its possessing great toughness. The rolled plates have been found more uniform in quality and of greater toughness than the hammered; and though the difficulties in their manufacture are grave, there is no departure from the ordinary practice followed in making large plates for other purposes. The difficulties which do exist are chiefly due to the immense weight and size and the intolerable heat of the mass, which must be dealt with while at a welding temperature.

The general size of the armour plates required for the plated frigates new building is from 15 ty 18 feet long, from 2 feet 6 inches to 3 feet 10 inches wide, and 4½ inches thick. The weight therefore of the finished plate ranges from 60 to 110 cwts.; and in the unfinished state it comes from the rolls at 80 to 140 cwts. From 3 to 4 inches is cut off the sides, and 10 or twelve from each end; and in this item of waste the hammering process has an advantage over the rolling.

The mode of manufacture of a 5 ton plate is as follows. Bars of iron are rolled 12 inches broad by 1 inch thick, and are sheared to 30 inches long. Five of these bars are piled and rolled down to a rough slab. Five other bars are rolled down to another rough slab, and these two slabs are then welded and rolled down to a plate of 1¼ inch thick, which is sheared to 4 feet square. Four plates like this are then piled and rolled down to one plate of 8 feet by 4 feet and 2½ inches thick; and lastly, four of these are piled and rolled to form the final entire plate. There are thus welded up together 160 thicknesses of plate, each of which was originally 1 inch thick, to form, when finished 4½ inches, making a reduction of 35 times in thickness; and in this operation from 3,500 to 4,000 square feet of surface have to be perfectly welded by the process of rolling. It is not surprising that even with the greatest care blisters and imperfect welds should exist and render the plate defective; this is the chief difficulty to be overcome, and a very serious one it is; and as the magnitude and weight of the plate increase so does also the liability to failure.

The final operation of welding the four plates of 8 feet by 4 feet by 2½ inches is a very critical matter. To bring a pile of four plates of these dimensions up to a perfect welding heat all through the mass, without burning the edges and ends of the plates most exposed to the fire; to drag this pile out of the furnace, convey it to the rolls, and force it between them, in so short a time as to avoid its losing the welding heat, is a matter of greater difficulty than those unacquainted with the work would imagine. The intensity of the heat thrown off is almost unendurable, and the loss of a few moments in the conveyance of the pile from the furnace to the rolls is fatal to the success of the operation.

A pile of four plates *A*, is heated in a special furnace *B*, as represented in the above engraving, and is drawn out by a liberating chain attached to the roll on to an iron carriage *C* which conveys the pile to the rolls *D*. The carriage *C* travels upon a line of rails let into the ground; and close in front of the roll frame is a small encline *E* upon the railway, which lifts up the front of the carriage at the moment of its arrival at the rolls, and enables it to deliver the pile upon the fore-plate. As the plate passes through the rolls it is received on the other side upon a roller frame *F*, which is set at a considerable inclination towards the rolls, so that the tendency of the plate is to return. The rolls are then reversed; and the plate which was pressing against them passes back through, and is received upon the carriage *C*; and again the operation is repeated until the 10 inches thickness is reduced to 4½ inches.

The plate is then lifted off the carriage *C* by the crane *G*, and deposited upon a massive cast-iron straightening bed *H*, and an iron cylinder *I*, weighing 9 tons, is rolled over it to and fro, being pinched along by hand levers, until the

---

[illegible]per read by Mr. John Brown, of Sheffield, at the [illegible]on of Mechanical Engineers, Birmingham.

curvature which the plate has acquired in the rolling is entirely removed. As soon as the plate is sufficiently cool, it is lifted off the straightening bed *H* by another crane, and laid upon a planing machine where the final operation of planing its sides and ends is completed.

In answer to questions by the chairman and other members, Mr. Brown replied that two trials of the plates had been made some time previously, to determine their power of resisting shot. But they were not satisfactory to the Admiralty or themselves; these were however their first attempts in rolling the armour plates, and they did not expect to succeed at once without some failures. He showed specimens of the broken portions of the plates, from which it was seen that the failure arose from the imperfect welding of the four thicknesses composing the armour plate in the final heat.

Two armour plates, however, lately tried at Portsmouth, had proved much more successful. The plates were 4½ inches thick, backed by 18 inches thickness of teak, and were fired at with shot 68 lbs. weight from a 95 cwt. smooth 8-inch bore gun, with 16 lbs. of powder, at 200 yards range. The first plate was 7 feet 9 inches long by 3 feet 2 inches wide: the first shot hit near a corner of the plate, where the weld was imperfect, and indented the iron to some depth; the second shot also hit near the same place and indented the plate; the third shot struck the plate in the centre and made a hole right through the iron, making a crack all round the opening; the fourth shot hit near the bottom and broke the lower edge of the plate in; and the fifth shot happened to go through the hole made by the third. The second plate, was nearly double the length of the first, being 14 feet long by 3 feet 7 inches wide: the first shot indented the plate 3 inches and broke out the iron at the centre of the indentation; the second shot punched right through and broke the backing; and the third and fourth shots each broke out a hole of 12 inches diameter and smashed the backing. A portion broken off one of the plates was exhibited, which showed that the iron was much more fibrous than in the plates made in the first attempts; and he expected still more favourable results would be obtained if the iron could be kept in a thoroughly fibrous state, so as to have a soft and tough quality, which was less easy to fracture than a hard and brittle metal.

Two of the armour plates were now in the hands of the Admiralty for further experiments; and trials had just been made at Shoeburyness of two of the plates 5 inches thick, which had proved altogether most satisfactory as to the tenacity and toughness of the plates. The object was to produce armour plates capable of resisting guns of increased power, and the experiments now made seemed to show that this might be effectually accomplished by the mode of manufacture that had been described.

GRAHAM'S STONE DRESSING MACHINERY.

Fig. 1.

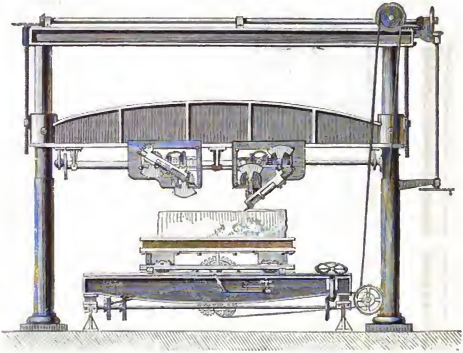
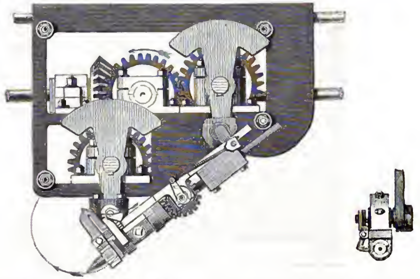


Fig. 2.



GRAHAM'S STONE DRESSING MACHINERY.

The above engraving illustrates a novel arrangement of machinery for reducing stone and other similar substances to a required size and form, and for producing a regular or smooth surface thereupon; the invention of Mr. W. Graham, of Manchester.

The machinery consists of a bed or table upon which the stone is placed, and to which a reciprocating sliding motion is imparted by ordinary mechanical and self-acting means. Above this table a beam extends from end to end of the machine, upon which a framing is supported in such a manner as to be adjustable, and carrying an arrangement of bevil gearing in connection with toothed wheels, which are attached by means of cranks to a tool box containing the chisel or chisels, and placed at the required angle for cutting, and the upper portion of this tool box is furnished with a weight, by which means the chisel is caused to cut or chip the stone. When motion is imparted to the gearing, the cranks will cause the chisel in the tool box to make a succession of strokes upon the stone, which by the effect of the weight or hammer, will cause the stone to be cut or chipped to any form or size, which, together with the depth of the cut, may be regulated or controlled by the attendant. In order that the edge of the chisel may not become unequally worn it is turned half round at each stroke by means of a crank or other convenient means, so that each side is presented alternately to the stone.

Fig. 1 represents a side view of the machine showing two chisels or cutters, as employed to act upon the stone supported upon the moveable bed or table; Fig. 2 is a detached view, showing the gearing for actuating the chisels or cutters.

The Council of the United Service Institution state they have the satisfaction of announcing that the Model, representing the commencement of the battle of Trafalgar, has been completed, and placed upon the table. It is made of oak from the "Victory," and is now ready for exhibition.

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.*

By Dr. F. Crace Calvert, F.R.S.

I cannot presume to give, in a paper like the present, an account of all the improvements and inventions which must have occurred in such extensive trades as those of dyeing and calico printing during a space of ten years, and especially during a decade of extraordinary progress like that which has just passed. The utmost, I can do is, to lay before you a principal discoveries which have ledge during the period under

I wish, however, to state that [illegible]ses of which I shall speak to-night are those generally known to calico printers, for it will be easily understood that many printers may use methods peculiarly their own, and that it would [illegible]e a breach of confidence were I to publ[illegible] any such processes that may have been communicated to me.

---

* Read before the Society of Arts, F[illegible], Dr. A M. Miller, F.R.S., in the chair.

I shall divide the subject into two heads. First, treating of new dyeing materials obtained from well-known dye stuffs, and then of dye-stuffs altogether new, together with their application to dyeing. Secondly, I shall consider the subject of calico printing.

Madder.—This valuable dyestuff, which is chiefly imported from France, Turkey, Italy, and Holland, is obtained from the *Rubia Tinctorum.* Our chemical knowledge of the composition of this root, so important to dyers and calico printers, was, up to 1851, in a most unsatisfactory state. Thus, whilst we find that MM. Decaisua, Jean Gerber, Edmund Dollfus, &c., asserted only one colouring principle, to which they gave the names of *alizarine, colorine,* or *azale,* others, such as MM. Persoz, Runge, &c., admitted two colouring principles, *alizarine* and *purpurine,* and Kuhlmann added to these two a third called *zanthine.* But Dr. Edward Schunck, F R.S., published, in 1851, his most valuable and extensive researches on the chemical composition of madder, which not only threw much light on the colour-giving principle of the rubia root, but also, as I will presently show, led to valuable commercial applications. He ascertained that although the roots contained a certain quantity of colouring matter called alizarine, yet that the ultimate source of this only colour-giving principle was a substance to which he gave the name of *rubian.* He further found that one equivalent of this substance under the influence of a ferment called *erythrozym,* or of acids, or alkalies, would, by losing 14 equivalents of water, be converted into 4 equivalents of alizarine, as the following equation shows:—

$$\underset{\text{Rubian.}}{C_{56}H_{34}O_{30}} = \underset{\text{Alizarine.}}{4\,(C_{14}H_5O_4)} + \underset{\text{Water.}}{14\,HO}$$

This result satisfactorily explained the change of madder into garancine by the action of sulphuric acid on that root, from the fact that rubian was susceptible of conversion, under the same influences, not only into alizarine, but also into two valueless substances called rubiretine and verantine. This led Dr. Schunck, in conjunction with Mr. Simon Pincoff, in 1852, to the production of a most important dyeing material, called by them *commercial alizarine.* But to enable you to understand in what this product differs from garancine, and also its mode of preparation, it is necessary that I should state that the verantine and rubiretine are not colour-giving principles, and that they interfere with the beauty and brightness of the fine shades of purple given by alizarine, which, according to Dr. Schunck, is the only colour-giving principle contained in madder.

Garancine, which, even before 1851, was extensively used for producing red, purple, and chocolate upon calico, was obtained, as you are aware, either by mixing together at an ordinary temperature equal weights of madder and sulphuric acid, then adding water, when the garancine was produced, requiring only to be thoroughly washed so as to remove the acid;—or by mixing the roots with one-third their weight of sulphuric acid previously diluted with water, and carrying the whole to the boil for one or two hours, washing the residue repeatedly, and using, in the last operation, some alkaline carbonate. Although garancine thus prepared gave colours similar to madder, yet they were wanting in solidity. This effect, especially as regards purples, was overcome by Messrs. Pincoff and Schunck, by taking principally garancine prepared as above, but thoroughly depriving it of acid, and submitting it to the action of high pressure steam, when the substance called verantine is decomposed or modified so as not to interfere with the purple dyeing power of alizarine. The advantages possessed by this product, which is now so extensively employed in calico printing, that several millions of pieces have been dyed with it, are, as stated by Messrs. Pincoff and Schunck, as follows:—It produces good lilacs economically and without soaping; great promptitude and regularity in the production; facility of producing combination of lilacs with catechu, lilac and chocolate, and lilac and orange, which results cannot be obtained so satisfactorily with madder or garancine; production of lilac shades graduated *ad libitum.* Lastly, economy of mordaunts. I shall again refer to this in speaking of calico printing.

Whilst on this class of madder products I may refer to an improvement effected by Mr. John Lightfoot, in the manufacture of garanceux, (which was discovered in 1843 by Mr. Schwartz), or spent madder, which has been treated with sulphuric acid, as above described, for the preparation of garancine. The method now generally followed is to collect the spent madder in bags as it runs from the dye-becks, and then throwing it on to a heap, to be ultimately converted into garanceux, by acting upon it as above described, with sulphuric acid. Mr. Lightfoot, however, recommends large vats to be provided, allowing to run into them the hot spent madder liquors of the dyebecks, together with vitriol, leaving the whole to stand for twenty-four hours, running off the clear liquor and washing the solid garanceux thus produced, until all impurities and acid are removed. The advantages claimed are, first, saving of fuel, by economising the heat of the waste liquors, and secondly, the production of one-fourth more colouring matter. Of late years the French calico printers have applied, for light styles of madder-pinks, extracts of madder, or garancine, which have generally been obtained by treating madders or garancines with alcohol or wood-spirit, and adding to them acetate of alumina and acetic acid; a similar process has recently been patented by Mr. F. A. Gutty. Another most interesting process has recently been published by Mr. Emile Kopp, for the production of alizarine from garancine. It consists in submitting dry garancine in a double cylinder to the action of superheated and saturated steam, when the alizarine is carried off by the steam, and the whole condensed in a refrigerator.

Flower of Madder.—This product, which is now extensively used by continental printers, and which was introduced to the trade by MM. Julian and Roquer towards the beginning of 1852, is prepared by allowing madder to ferment, and then washing it thoroughly, which removes from it, not only all soluble matters such as sugar, mucilaginous substances, acids, &c., which interfere with the fixation of the alizarine on the various mordaunts, but also (in accordance with Dr. Schunck's researches on the influence of the ferment erythrozym on rubian), increases the quantity of colour-giving principle or alizarine. It is found, by experience, that 100 parts of flower of madder are equal to about 200 parts of ordinary ground roots, and that the shades are finer, the pinks and reds also having greater solidity. Mr. E. Mucklow has recently patented a process similar to the above, which consists in alternately macerating and pressing madder roots so as to expel from them various materials which, as above stated, interfere with the dyeing of the fabrics.

Mr. Emile Kopp has published a very interesting paper on the subject of madder, in which he proves that, if the madders of Alsace are treated with a weak solution of sulphurous acid, and to this solution, which has a fine golden colour, he adds three or four per cent. of hydrochloric acid, and heats the whole to a temperature of 150°, a red colouring matter is precipitated, which he states to be pure *purpurine.* If, after the separation of this precipitate, the liquor is again carried to the boil, a new colouring matter is formed, which he calls *green alizarine,* and finds to be composed of pure alizarine and a dark green resin, which he considers is produced by the decomposition of chlorogenine.

As a *resumé* of my observations on madder, I may state that the only two madder products which have received extensive application since 1851 are commercial alizarine and flower of madder.

Indigo.—I have the pleasure again to draw your attention to a series of researches by Dr. Edward Schunck, and to enable you to appreciate the value of his discoveries in connexion with this important dyestuff, it is necessary that I should first state that chemists held two different opinions as to the condition in which the colouring matter existed in the indigo plants. Thus, Chevreul, Girardin, &c., considered that the indigo contained in the plant was in the form of white, or de-oxygenated blue indigo; whilst Gichert and others believed that it did not pre-exist in the vegetable, but was formed during the process of fermentation, which is usually employed for the extraction of the colour from the *Isatis tinctoria* and *Indigofera anil.* Serious doubts having arisen in the mind of Dr. Schunck, whether either of these theories correctly explained the state in which indigo existed in the indigo plant, he undertook a long series of researches, by which he was enabled to show, with a positive certainty, that the *Isatis tinctoria* contains a substance easily soluble in hot and cold water, alcohol, and ether, and which, by the action of strong mineral acid, yields indigo blue. Further, that the formation of the colouring matter from it can be effected without the intervention of oxygen, or of alkalies, and that the latter, indeed, if allowed to act upon it before the application of acid, entirely prevents the formation of the colouring matter; viz., indigo blue. To ascertain whether the substance which he calls *indican,* pre-existed in the plant, Dr. Schunck operated as follows:—He digested in ether some perfectly dry leaves of the *Isatis tinctoria,* removed the ethereal solution, and having exposed it to spontaneous evaporation, it left a green syrupy residue, from which water extracted *indican,* for by the action of boiling sulphuric acid, it yielded an abundance of indigo blue. To obtain the *indican* in a high state of purity, he found it necessary to treat the leaves with alcohol and ether, and to submit the extract to various chemical operations, to get rid of all impurities, so as to obtain *indican* as a yellow transparent glutinous substance, of a slightly bitter and nauseous taste. This substance presents the remarkable property (similar to that of rubian in madder) of being susceptible under the influence of a ferment in the plant, or of acids, of yielding indigo blue and sugar, as seen by the following chemical formula:—

$$\begin{array}{l} \left.\begin{array}{l}\text{1 eq Ind. } C_{52}H_{31}NO_{34} \\ \text{4eqsWter. } \quad H_4 \;\; O_4\end{array}\right\} = \left\{\begin{array}{l}C_{16}H_5NO_2 \text{ 1 eq Ind. blue} \\ C_{36}H_{30}O_{30} \text{ 3eqs Sugar}\end{array}\right. \\ \qquad C_{52}H_{35}NO_{38} \qquad\qquad C_{52}H_{35}NO_{38} \end{array}$$

To obtain this interesting decomposition with acids, it is simply necessary to heat the indican with strong sulphuric or hydrochloric acid, when the indigo blue precipitates while the sugar remains in solution. But indican is so liable to undergo modifications, that if the action of the acids be continued, besides the indigo blue an indigo purple is formed, called by Dr. Schunck *indirubine.* To fully appreciate the value of these researches it is necessary that I should lay before you an outline of the manufacture of indigo, as some of you may not be acquainted with it. Commercial indigo is obtained from plants belonging to the leguminous tribe, known under the general name of *indigofera,* that these plants are mowed and placed in large vats with water, and allowed to ferment for eight or ten hours, when the supernatant liquor first becomes green and then blue. It is then run off into other vats and well agitated, so as to bring it thoroughly under the action of the atmospheric oxygen, when the white soluble indigo becomes thoroughly oxydised into blue insoluble indigo. A little lime water is now added and the whole left to settle, the deposit collected on a cloth, drained, pressed, divided into square lumps, and dried in the sun, when it constitutes commercial indigo. Dr. Schunck's researches show, as above stated, that under the influence of a ferment the *indican* is converted into sugar and white indigo; and they also explain that if the manufacturer is not extremely careful he may experience great loss in the amount of indigo obtained, for Dr. Schunck has observed that *indican,* when dissolved in water, is liable to undergo rapid modifications, and that instead of yielding by the acids indigo blue and *indirubine,* it gives *indiretine, indihumine*, &c. You will, doubtless, be struck with the great similarity which exists between the colour-giving principles of the madder and indigo plants, and with the light thrown upon this class of tinctorial matters by the laborious researches of Dr. Schunck. I cannot leave this interesting substance without stating that, although one or two attempts have been made to introduce new preparations of indigo, they have not, to my knowledge, yet received the sanction of the trade. Such are the preparations of the sulpho-indigotic acid of Mr. Haeflly, the sulpho-purpurate of soda of Mr. Bolley, and the indigo of Mr. Johnson.

Orchil.—It is hardly necessary for me to state that this dyestuff has been used for producing violets, mauves, reds, and other colours for many years, and that the colouring matter was obtained by allowing lichens to remain in contact at natural temperature for several weeks, with putrid urine and a little lime, and that of late years ammonia has been substituted for urine, with the addition of a little carbonate of soda, nitrate of soda, or alum. You are also, doubtless, aware that Robiquet was the first to obtain a colourless principle called *orcine*, and to show that under the influence of oxygen and ammonia it became transformed into water, and a red colour called *orcéine*, and that Dr. Schunck proved that a substance extracted by him under the name of *lecanoric acid*, from lichens, would, under the influence of heat and a solution of baryta, decompose itself into water, carbonic acid, and orcine. Without overlooking the interesting researches of Heeren and Sir Robert Kane on this subject, I must especially mention the labours and valuable researches of Dr. Stenhouse, which not only added greatly to our knowledge of the various chemical principles existing in lichens from which the orchil colouring matters are obtained, but also led him to discover a commercial method of extracting from the lichens the various organic substances capable of giving orchil colours when placed in favourable conditions. He also showed that the very small per-centage of colouring matters in proportion to the bulk of weed might be cheaply and commercially extracted in the locality where the lichens grow, thus saving the enormous expense of carrying a large bulk of useless matter from Africa and elsewhere to this country. If this valuable hint of Dr. Stenhouse's has not yet been acted upon as regards the saving of transport, his process for extracting the colour-giving principle has of late years been extensively adopted by manufacturers of orchil, enabling them to obtain cheaper and better colours from lichens. But still none of these advantages led manufacturers to the great desideratum of giving fastness to the beautiful purple shades obtained from orchils until 1856, when Mr. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, found that by treating lichens, as suggested by Dr. Stenhouse, with milk of lime, filtering the lime liquor off and precipitating the colour-giving principle from it with hydrochloric acid, gathering these on a filter, and after having properly washed them, dissolving them in caustic ammonia, and keeping this ammoniacal liquor at a temperature of 153° to 160° for 20 to 25 days, when under the influence of that temperature, the colour-giving principles of the lichens fix ammonia and oxygen and are transformed into a new series of products, which Mr. Marnas separates from the coloured liquor by adding chloride of calcium, which causes a fine purple lake to be deposited, which, after being well washed and dried, is sold under the name of *French purple*. It is easy to understand that the chloride of calcium can be replaced by salts of alumina, tin, &c. What characterises this orchil colour from those previously known is, that it dyes animal fibres with greater facility than the common orchil, that it gives directly mauve colours, which can be modified by adding to them a little carmine of indigo, roseine, &c.; but the essential difference of these purples and mauves from ordinary orchil colours is—that while the latter are destroyed by acids and light, those of Mr. Marnas, on the contrary, withstand their action, thus accounting for the public favour given to Messrs. Guinon, Marnas and Co.'s orchil colours. To dye silk or wool with French purple it is simply necessary to mix the lake with its weight of oxalic acid, boil with water and then filter, the oxalate of lime remaining on the filter while the colour passes in the filtrate. This liquor is then added to a slightly ammoniacal liquid contained in the dye-beck; all that is now necessary is to dip in the beck, silk, wool, cotton, mordaunted with albumen, or cotton prepared for Turkey red, when any of these materials will become dyed with magnificent fast shades of purple or mauve. It is a curious coincidence that after many years of anxious search, two purples from widely different sources should have been first discovered in the same year (1856) in different countries. I allude to Mr. Perkin's purple from coal tar, to which I shall refer further on.

Catechu, or *Terra Japonica*, which is extracted from the wood of the acacia catechu, and which we import in large quantities from the East Indies, is daily becoming of increased importance, owing to the great variety of colours that can be obtained with it. It contains two very distinct substances, a tannin (studied by Dr. Stenhouse) which gives a green precipitate with salts of peroxide of iron, and also a substance called *catechine*, which under the influence of alkalies and oxygen is rapidly transformed into two acids called japonic and rubinic acid. As in catechu, the tannin gives various shades of drab, the catechine giving, with proper metallic salts, salmon, red, and wood colours. Some calico printers have of late, under my advice, washed with cold water pulverised catechu, which dissolves freely the tannin, leaving the catechine insoluble in cold water, which, however, being soluble in hot water, becomes susceptible of application.

Aloes.—Owing to the interesting researches of Drs. Schunck and Stenhouse upon the resin obtained from the *aloe socotorina*, and imported from the East and West Indies as well as Africa, the various colouring matters obtained by them have, of late, been employed by the French dyers for producing pinks, violet, maroons, and other shades.

Lac Dye.—Messrs. Haworth and Brooke, of Manchester, have introduced into commerce a lac dye superior to that imported from India, which, as you are aware, is prepared from stick lac. Their improvement consists in treating stick lac with weak ammonia, and adding to this solution chloride of tin, when a fine red insoluble matter is formed, which precipitates. This is collected, and is ready for use.

Chlorophyll.—For many years attempts were made to fix upon fabrics the green colouring matter of leaves, but unsuccessfully, until, in 1854, MM. Hartmann and Cordillott, of Mulhouse, succeeded by the following simple process in obtaining on silk, wool, and cotton, fine green brilliant and solid colours. After having boiled a quantity of grass, so as to remove everything soluble in boiling water, it was heated with a hot caustic lye of specific gravity 1·03, this alkaline solution being then neutralized with hydrochloric acid, a fine green precipitate was thrown down. This precipitate was then dissolved in a solution of caustic lye, to which had been previously added some phosphate of soda and oxide of tin. This mixture, properly thickened with gum, was printed and fixed by steaming. No doubt, by a slight modification in the *modus operandi*, this colour might be applied to dyeing.[*]

Chinese Green, called *Lo-kao.*—In 1851 and 1852 public attention was drawn by several English gentlemen to samples of a green colouring matter, imported from China, and in 1853 Messrs. Guinon, of Lyons, imported such quantities of the material as to enable them to dye silks for the requirements of the trade. The silks so dyed by them, under the names of *Vert-Venu Vert-Azof, and Vert-Lumière*, were especially admired, from the beautiful green shades they assumed in artificial light; and although the price of the dye fell from £21 per pound in 1858 to £4 in 1860, these beautiful shades of green (especially under artificial light) have almost disappeared from the market owing to the two following reasons—first, their want of stability; and, secondly, because Messrs. Guinon, Marnas, and Bonnet have found the following means of producing, at less cost, shades of green which also maintain this character under the influence of artificial light, *i.e.*, by first dyeing their silks in Prussian blue, and then dyeing them in an acidulated bath of carboazotic or picric acid. It is an interesting fact to observe that while the greens produced with indigo and picric acid appear blue in artificial light, those produced as above with Prussian blue and picric acid appear green under the same conditions. I cannot leave this interesting subject without making two further remarks. First, Lo kao is the only substance with which I am acquainted capable, with proper re-agents, of producing the seven colours of the spectrum; secondly, that, thanks to the advanced state of chemical and botanical science, we have succeeded in producing in Europe the identical substance imported only a few years ago, as a great novelty, from China, and for which, but for those sciences, we should still probably have remained tributary to that empire. Thus, Mr. Charvin, of Lyons, has been able to obtain Lo-kao from a weed indigenous to Europe, viz., *Rhamnus catharticus*, for which he has received, from the Chamber of Commerce of Lyons, a gold medal worth 6,000 francs.[*]

Murexide of *Roman Purple.*—The colour to which I am now about to draw your attention furnishes another example of the assistance which the progress of chemical science has rendered to the art of calico printing. In 1776, the illustrious Swedish chemist, Scheele, discovered, in human urine, uric acid. In 1817, Brugnatelli found that nitric acid transformed uric acid into a substance, which he called *erythric acid*, but which was subsequently called, by Wohler and Liebig, *alloxan*. In 1818, Dr. Prout found that the latter substance gave, when in contact with ammonia, a beautiful purple red colour, which he called purpurate of ammonia—the product known by the name of *murexide* since the researches of Liebig and Wohler, published about 1837. These discoveries remained dormant in the field of pure science until the year 1851, when Dr. Saso observed that when alloxan came in contact with the hand it tinged it red. This led him to infer that alloxan might be employed to dye woollens red, and further experiments convinced him that if woollen cloth were prepared with a salt of tin, passed through a solution of alloxan, and then submitted to a gentle heat, a most beautiful and delicate pink colour resulted. In 1856, MM. Depouilly, Lauth, Meister, Petersen, and Albert Schlumberger, applied it as a dyeing material to silk and wool, and succeeded in obtaining red and purple colours, by mixing the murexide with corrosive sublimate, acetate of Soda, and acetic acid For printing, a mixture of murexide with nitrate of lead or acetate of zinc, properly thickened, is applied on cotton fabrics, which are then allowed to dry for a day or two, when the colour is fixed by passing them through a mixture of corrosive sublimate, acetate of soda, and acetic acid. The Roman purple style of printing has been carried out extensively by Messrs. Edmund Potter and Co.; Boyd, Sons and Hamel; and James Black and Co. No doubt you will wonder whence such quantities of uric acid, or murexide, could be drawn to supply a demand like that which has arisen. This result has been achieved by the following process of extracting uric acid from Peruvian guano. Guano is treated repeatedly with hydrochloric acid, until all soluble matters are removed by heat and washing. The insoluble mass, which consists chiefly of sand and uric acid, is carefully treated with nitric acid of specific gravity of 1·40. When the action of the acid is completed, the mass is treated with warm water, and thrown on a filter. The filtrate, which has a yellowish colour, and contains alloxan, &c., is evaporated carefully to such a degree, that when left to cool it becomes a brownish red or violet solid, called by the inventor, *carmin de pourpre*, which is the substance chiefly used for printing, as above described. It is to the enterprizing commercial spirit of Mr. Robert Rumney, chemical manufacturer, of Manchester, that is due the extensive production and application of murexide in this country.

---

[*] Any one who wishes for further information on the green colouring matter from plants, will find a most interesting paper by M. Fremy, published in the *Comptes Rendus* of the French Academy, for 1860, volume 50, in which that chemist shows that chlorophyll is composed of two colouring matters called phylloxanthine and phyllocyanine.

[*] For full details on this subject, see Report presented to the Chamber of Commerce, at Lyons, by the Rev. M. Hélot, M. Persoz, &c.

Doubtless you are aware that alum, and cream of tartar, are largely used as mordaunts in the dyeing of silk, wool, and cotton, and that the latter substance has much risen in price, owing to the failure of the wine crops of late years; therefore, any process for economising the use of of cream of tartar is a matter of importance. I am happy to state that Mr. Kuhlmann has, within the last few weeks, published in the Mémoirs of the French Academy, a paper in which he furnishes a means of attaining that end. Having first confirmed a most important observation of Mr. Chevreul's, viz., that when cream of tartar is used as a mordaunt, it is decomposed into tartaric acid, which adheres to the fibre, and into a neutral tartrate, which remains in solution and is lost, and that if, on the contrary, instead of using the cream of tartar as a mordaunt, it is first decomposed into tartrate of baryta, and that this salt be used as a mordaunt, in connection with a little hydrochloric acid, the two equivalents of the tartaric acid of the cream of tartar become available, and consequently a saving of one-half the quantity of cream of tartar formerly used is effected.

In the hope that it may prove interesting to the members of this Society, I will now give some details respecting a few new processes for dyeing silk, before proceeding to treat of coal-tar colours.

Catechu Black.—The silks are first passed into a solution of salts of peroxide of iron, then into a hot soap solution containing an excess of soap, from whence they are passed into a slightly acid bath of prussiate of potash. The silks which have thus been dyed Prussian blue, are dipped in a solution of persalt of iron, having a specific gravity of 1·15, the object of which is to give an iron mordaunt to the silk. They are then thoroughly washed and passed into a bath of catechu for organzine at 203°, and for tram at 172°, the silks being worked in this bath until it is cold, so as to saturate thoroughly the iron mordaunt with the colouring principle of catechu, and thus produce a black. They are then wrung on the peg and exposed to the atmosphere for 24 hours, after which they are passed into a soap solution at 150°, washed thoroughly, and the organzine is then dipped in a bath of weak acetic acid, and the tram in one of weak hydrochloric acid; finally, the silks are passed through an emulsion of oil, well worked on the peg and allowed to dry. These last operations are intended to remove, by means of the fatty matters, the harshness which the silk would otherwise possess.

The following is a process for preparing dyed silks, so that when woven into fabrics these will be fit for taking the moire antique:—Two parts of pure olive oil are mixed with one of concentrated sulphuric acid, and agitated until sulphurous acid begins to be liberated. It is then well mixed with 15 parts of lukewarm water, and the whole further diluted with boiling water. The silks are then passed into this bath and then into a second similar bath, to which has been added a little free vitriol, After this, they are successively dipped in a hot bath containing a little citric acid, then into the previous No. 2, to which is added a little sulphate of alumina and a little black dye to restore to the silk any colour it may have lost during the former operations. The silks after having been dried in the air, are ready for weaving. The object of these processes is to introduce into the silk fatty acids, the property of which is to communicate to the silk a great degree of softness, and adapt it to receive, by intense pressure, the intended moire.

I will now describe a process for dyeing silks white. The silks, after having been boiled, are first past into a slightly ammoniacal bath, and from thence into another of water, in which has been dissolved a little French purple, and lastly, into another bath containing lukewarm water, to which is added, in successive portions, some carmine of indigo, and the silks are then dried. Many of you will doubtless remember that in my papers read here in 1851, I explained that, when the three primitive colours of the spectrum are mixed in due proportions, they produce white if reflected, and black if absorbed. The French purple gives the red; the carmine of indigo, blue; and the silk itself the required yellow.

Several improvements have also taken place in the production of maroons, greens, and Prussian blues, but time will not allow of my laying the details before you.

Colours derived from Coal Tar.—These colours are as interesting for their beauty and brilliancy as for the source from whence they are derived, and present a remarkable instance of the valuable services which abstract science so frequently renders to the material interests of society. How little did even chemists dream that a substance first perceived by Unverdorben, in the year 1826, then named *aniline* by Fritsche, and discovered in coal tar about 1841, by Dr. A. W. Hofmann, would lead to the production of such magnificent colours as aniline, purple, magenta, &c. There can be no doubt that it is to the interesting and learned researches of Dr. Hofmann on aniline, that we owe the possession of these splendid colours, and further, it was one of his pupils, Mr. A. Perkin, who produced for the first time, on a commercial scale, aniline, and then the splendid purple colour which it is susceptible of yielding. Before describing to you the process patented by Mr. Perkin, in 1856, to produce his purple, allow me to lay before you an outline of the present plan followed for obtaining aniline. A carburetted hydrogen, which I mentioned to you in one of my previous papers, called "Benzine" ($C_{12} H_6$), and obtained by the careful distillation of purified coal naptha at a temperature of 186°, is treated with strong nitric acid, when a violent action ensues, which gives rise to nitrobenzine or $C_{12} H_5 NO_4$. To convert this compound into aniline, one hundred parts of nitro-benzine are mixed with an equal quantity of acetic acid, and 200 parts iron filings, heat is produced, and the following chemical action ensues.

$$\underset{\text{nitro-benzine.}}{C_{12} H_5 NO_4} + \underset{\text{water.}}{2 H O} + \underset{\text{iron.}}{4 Fe} = \underset{\text{oxide of iron.}}{2 (Fe_2 O_3)}$$
$$+ \underset{\text{aniline.}}{C_{12} H_7 N}$$

The whole is then introduced into a retort, and the raw product which passes from it is mixed with a little alkali or lime, and again distilled, when aniline is obtained. This important substance is, as you perceive, a colourless fluid, which boils at 459°, has a decided alkaline reaction, and a sp. gr. of 1·028. The following is the process described by Mr. Perkin for preparing his purple. Solutions containing equivalent proportions of sulphate of aniline and bichromate of potash are mixed and allowed to stand till the reaction is complete. The resulting black precipitate is then thrown on to a filter and washed with water until free from sulphate of potash; it is then dried. This dried product is afterwards digested several times with coal-tar naptha, until all resinous matter is separated, and the naptha is no longer coloured brown. After this it is repeatedly boiled with alcohol to extract the colouring matter. This alcoholic solution when distilled leaves the colouring matter at the bottom of the retort, as a beautiful bronze-coloured substance, which may be considered as Mr. Perkin's commercial aniline purple. This colour, which can also be produced by oxidizing aniline by other metallic salts, is slightly soluble in water, freely soluable in alcohol, and presents the remarkable property of not being affected by light, alkalies, or acids. To dye wool or silk with it, is simply necessary to add to a hot water bath, slightly acidulated with tartaric acid, some of the alcoholic solution of aniline purple, and to work the silk in the said bath, wringing and washing it; the purple shade thus produced can be modified with rosin, Prussian blue, or sulphate of indigo. To dye cotton so as to resist the action of soap and light, the process is modified so as to form on the cotton fibre an insoluble compound of colouring matter with tannin and a metallic base. To effect this the cotton is passed for an hour or two into a bath containing a tanning substance, and then into a weak solution of stannate of soda, wrung out, passed into an acid liquor, rinsed in water, and then, like silk, dipped into an acidulated bath of purple aniline. Also cotton prepared with a basic salt of lead, or as for Turkey red, will take up aniline purple. On the 12th January, 1861, another interesting process to obtain aniline purple was patented by Mr. Adam Girard. Pure red aniline (known in this country as magenta), is mixed with an equal weight of aniline, and the mixture heated for several hours to 329°, when the mass is changed to a fine purple colour, requiring only to be mixed with water and hydrochloric acid, to remove any aniline or red dye in excess, leaving the purple insoluble, but, on being well washed with water, this becomes soluble in alcohol, acetic acid, wood naptha, and boiling water slightly acidulated with acetic acid.

Whilst on this mode of producing purple aniline, I may say that blue dye may also be obtained with the above insoluble purple residue by boiling it several times with hydrochloric acid diluted, say ten parts of commercial acid to 100 parts of water, when the purple is converted into a blue dye.

Mr. Charles Lauth also published, on the 24th December, 1860, an ingenious method of obtaining purple aniline, which I shall describe when treating of blue colours obtained from aniline.

(*To be concluded in our next.*)

Proceedings of Societies.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Feb. 13—Mr. Francis Campin, President, in the chair, "On the methods of Illuminating Lighthouses." By GEORGE B. JERRAM, C.E.

The author commenced his discourse by directing the attention of the meeting to the vast importance of being provided with adequate means of illuminating the lanterns of lighthouses, and briefly reviewed the past history of those structures with reference to the modes of lighting which have from time to time been adopted.

If it be desired to illuminate the whole space surrounding any spot, a lamp or candle suffices, but if a certain part only of the horizon is desired to be illuminated without losing any rays, it then becomes necessary to adopt some mechanical contrivance to collect the rays which are not proceeding in the desired direction, and to pass all on together to the spot to be illuminated. This was successfully carried into practice by M. Teulere, of France, in the Corduan lighthouse, where he applied paraboloidal reflectors at the backs of the lamps, this is called the catoptric system, from a Greek word which signifies a mirror. The efficiency of the paraboloid form depends upon the following property of the parabola, by the revolution of which the surface of the reflector is generated. If a right line be drawn from the focus of a parabola to touch the curve, and at the point where it touches a tangent be drawn, from which another line, making with the tangent an angle equal to that made by the line from the focus, is also drawn, then will the last line be always parallel to the axis of the curve. Hence, if a luminous point be placed in the focus of the reflector above described, it follows that all the rays proceeding therefrom, will be collected and sent forward as a parallel beam; it is however necessary that there should exist some divergence, otherwise the light would scarcely be perceptible at a distance, and this divergence is obtained by the use of a lamp of which the flame is of some definite diameter.

The author then proceeded to explain the mechanical arrangements, and the method of constructing catoptric apparatus.

The attention of the meeting was next drawn to the dioptric system of distributing the rays of light, which is by refraction, being illustrated by the apparatus prepared to illuminate the Portland Breakwater, which was placed upon the table and illuminated throughout the evening.

The author then proceeded to discuss the relative merits of the electric and lime lights, the latter being illustrated by a small lime light in action, and also to explain the nature and advantages of the magnesium light, which was also experimented upon.

The dioptric apparatus on the table was lent by Messrs. Wilkins of Long-acre, and several lime lights suitable for the illumination of lighthouses, etc., were furnished by Mr. Standly, of Cockspur Street.

The reading of the paper was followed by an animated discussion, in which Messrs, Leadbeater, Gumpel, Rawlinson, Walton, Yarrow, the President, and the author of the paper, took part.

MEETINGS FOR THE WEEK.

Mon.—*Royal Geographical Soc.*, I. "Report on the Brazilian Province of the Parana," by the Hon. H. P. Vecker. II. "The Republic of Nicaragua," by G. R. Perry, Esq., H.M. Vice-Consul. III. "Proposed Transit Route through Central America, by way of Nicaragua," by Captain Bedford Pim, R.N., at 8.30 p.m.

Medical Soc., "On Lithotrity: Its Practical Application," by H. Thompson, Esq., F.R.C.S., at 8.30.

London Inst., "On the Grecian Drama, with Readings from original English Versions and Choral Illustrations from the Plays of Æschylus, Sophocles, and Euripides," by the Rev. C. M. Davies, A.M., at 7. p.m.

Tues.—*Zoological*, at 9 p.m.

Royal Inst., "On Sound, and Special Organs and Sense of Hearing in Man and Animals," by J. Marshall, Esq., at 3 p.m.

Inst. Civil Engineers, Renewed Discussion upon "Iron-plated Ships," by Joseph D'A. Samuda, at 8 p.m.

Society of Arts, "On the Art of Constructing Turkish Baths and their Economy as a Means of Cleanliness," by D. Urquhart, Esq., at 8 p.m.

Wed.—*London Inst.*, "On Commercial Law," by G. W. Hastings, Esq., at 7 p.m.

Geological Soc., Special General Meeting previous to the reading of the following papers:—I. "On the Drift containing Arctic Shells and other fossil remains, in the neighbourhood of Wolverhampton," by the Rev. W. Lister, M.A. II. "On Split Erratic Blocks," by James Smith, Esq., F.R.S. III. "On the Ice-worn Rocks of Scotland," by T. F. Jamieson, Esq., F.G.S. IV. "On the Glacial Origin of certain Lakes in Switzerland, Wales, Scotland, and elsewhere," by Prof. A. C. Ramsay, F.R.S., at 8 p.m.

Soc. for the Encouragement of the Fine Arts, Conduit St., "First Conversazione of the Season," at 8 p.m.

Thur.—*Civil and Mechanical Engineers*, "On the Supply of Power for Acting Prime Movers," by A. F. Yarrow, Esq., at 7.30 p.m.

Royal Soc., at 8.30 p.m.

Antiquaries, at 8.30 p.m.

Royal Inst., "On Heat," by John Tyndall, Esq., at 3 p.m.

Fri.—*United Service Inst.*, "The Importance of a Knowledge of Geology to Military Men," by Lieut. F. W. Hutton, F.G.S., at 3 p.m.

Royal Inst., "On Sleeping and Dreaming," by A. E. Durham, Esq., at 9 p.m.

On Tuesday last, in the House of Commons, Mr. Roebuck moved for leave to introduce a Bill to amend the law relating to trade marks. Trade marks, he observed, acquired a reputation, and consequently a money value; and his object was to preserve to the proprietor of the mark the exclusive possession of his symbol. These marks were now liable to be forged, and were extensively forged, and persons obtained a dishonest livelihood by placing the marks of other manufacturers upon spurious or defective articles. The Bill he proposed to bring in had been drawn up at Sheffield; he explained its enactments, and suggested that the Bill and another, of which the Government had given notice, should be referred to a Select Committee. Mr. M. Gibson, premising that the Government were ready to assent to the course proposed, noticed some of the difficulties attending legislation upon the subject, the aim of which should be, he said, to put down real fraud without frivolous and vexatious prosecutions. The main difficulty was to determine what was a trade mark. Mr. Locke said those manufacturers ought to be looked after who put their own genuine marks upon defective articles. After some further discussion the motion was agreed to.

TO CORRESPONDENTS.

Received.—G. W., E. E. S., E. H., A. R., H. D. P. C., Dr. W., C. W. L., W. H. E., G. S., R. A. E. S., G. W., J. W., J. G. F., F. W., R. P. E., E. E. W., C. and Co., W. T.

G. W.—Persons in the country can become members of the London Society for the Prevention of Steam Boiler Explosions. We cannot answer the second question.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

RIFLE ROCKETS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In the papers by Mr. Bridges Adams, "On the Rationale of Small Arms and Artillery," October 5th, 1860, that gentleman has introduced a form of shot, and the *principles of its construction*, which I advocated some years ago, not only in a lecture "Upon the Construction of Shot and Cannon," which I had the honour to deliver in the lecture room of the United Service Institution, illustrated with diagrams, but also in August, 1855, in the numbers 1669, 1670, and 1671 of your own Magazine.

I do not in the least intend to accuse Mr. Adams of plagiarism, for he may not have seen my papers on the subject, and I am very glad to find that so ingenious a person should have taken up the idea as he has, and explained it so well, for I fully believe that this form of shot, having a tapering end next the charge, whatever the front may be, and *provided with a proper wadding*, will eventually supersede all others, whether for rifles or plain-bore fire-arms, and I believe that Sir William Armstrong has, in some degree, adopted this form for his projectiles.

Another circumstance I wish to establish my claim to in your pages, viz., that I was, I believe, the first inventor and practical exhibitor of rifle rockets, by causing the rotation in their flight by directing the escape of the gaseous product of the combustion of the charge in oblique tangental lines to the axis; this was in the year 1824.

Subsequently, but many years afterwards, Mr. Hale made this the subject of a patent, but in quite a different form, still taking the same principle.

The occasion when I first publicly exhibited these rockets, was at a competitive trial of my construction of rocket against those of Sir William Congreve, at the head quarters of the Bengal Artillery, Dum Dum, on the 31st May, 1824, before Lord Amherst, the Governor-General, Sir Edward Paget, the Commander-in-Chief, and a large concourse of military and civil spectators, when it was publicly, officially, and privately admitted that my rockets had a decided superiority *in accuracy of range* over those of Sir William Congreve, and Mr. Hale, if he sees this paper, will recollect that he called upon me, I think, on the recommendation of Colonel Chalmers, of the Royal Artillery, when I was living in St. George's-terrace, Kensington New Town, to consult me on the subject of the patent he was about to take out, with an idea that he could dispense with the shaft of the rocket, which I advised him not to attempt, not that I believed that he could not make a rocket range without it, but in consequence of the inferiority which such a weapon would have.

I do not in the least desire to undervalue Mr. Hale's rockets, and I am glad that he has met with the success which has, I believe, attended them, but I am still convinced that *without a shaft* a rocket cannot be the formidable and excellent projectile it is capable of being, particularly in horizontal range, direct momentum and penetration, which it is when properly made, and a proper shaft applied.

To prove that my rockets, in the year 1824, had this rotary motion, I give two extracts from a long letter written by a spectator, unknown to me, in the Calcutta paper, the *John Bull*, of the 1st of June, 1824:—

"Captain Parlby's rockets had a manifest superiority over Sir William Congreve's in the comparative trial yesterday, 31st May, 1824. His rockets kept a perfect direction until they came in contact with the ground, while Sir W. Congreve's, after proceeding straight for some distance, frequently swerved. This circumstance will evince the undoubted superiority of Captain Parlby's plan, as he gives his rocket a rotary motion."

Again:—

"Target, 600 yards; volley of nine small rockets. The volley of rockets in this discharge was a complete failure on the part of the Congreve rocket, six out of the nine burst within 100 yards of the target, another fell half way, and the two remaining rockets went to a considerable distance right and left of the target. Of the Parlby rockets, only one burst, two struck the target, and the remaining six preserved the line, and passed over it within a few feet of the top."

I may mention that my rockets, on this occasion, were made under great disadvantage, having been suddenly called upon, by official authority, to prepare 70 rockets of different sizes for the competition of an equal number of Sir W. Congreve's, and having at that time no establishment, but only unsuitable private buildings to put up my apparatus.

When the failure of the Congreve rockets, their irregularity of flight, bursting, and other causes became publicly noticed, I was called upon in 1826 to establish a rocket manufactory at Allahabad, in connection with the powder works of which I was agent, and the nature of the rockets I was then able to produce will best appear from the extracts of the letters which I place before you. All these rockets were made to have the rotary motion, which is a part only of the principle of my construction.

Perhaps you will permit me to add that all my personal labour, and the public expense incurred, were rendered fruitless by the arrival of Lord William Bentinck in India in 1828, as Governor-General, who determined to pursue the object of retrenchment in all possible cases, and thought proper to close both the agencies for gunpowder at Islapore and Allahabad, involving the rocket establishment, for a certain period, and ordering all the establishments to be discharged at one month's notice! India was at peace! How long it remained so history tells!

I came away from India, and since my return, numerous unserviceable batches of rockets have been sent out, all proving more or less unserviceable.

I have made repeated attempts, by communications with the public authorities in England, to prove the superiority of my weapon over that made at Woolwich, but my proposals have not been attended to, so that a large amount of the public money of the nation is still squandered in providing an imperfect weapon, so imperfect indeed, that as a weapon of warfare it is falling into contempt.

During the late mutiny in India, when the present Commander-in-Chief in India was commanding the central army near Calpee, in Bundlecund, a large body of the enemy's cavalry appearing, on the 28th May, 1858, the rocket troop was called to act upon them (a case in which *good rockets* would have been of the utmost service), but the failure of the weapon was so complete and disgraceful that Sir Hugh Rose ordered the rockets to the rear as useless, and worse than useless, as dangerous to ourselves.

The statement by a general officer present is as follows:—"In the battle at Golowlee, the day before the action in the capture of Calpee, in Bundlecund," the general writes, "at the moment of the advance of a dense mass of the enemy's cavalry on the 22nd May, 1858, our rocket firing was a perfect failure; one or two rockets hissed off from the tubes towards the enemy, and then suddenly buried themselves in the ground, and one or two others whizzed about erratically in the sky, and then turned back upon their friends, who had wished them good speed; so the general, now Sir Hugh Rose, ordered these dangerous things to the rear."

Even in Captain Boxer's "Course of Artillery and Fortification," published by authority, 1860, for the use of the Royal Military College, Sandhurst, whose situation as Superintendent of the Royal Laboratory at Woolwich, and whose well-known abilities add force to his opinion, finishes his description of the rocket thus:—

"The present service rocket has one great defect, namely, great *irregularity of flight*.[*] If this be overcome, the rocket would be a most formidable weapon, if used in large numbers."

Yours obediently,
Samuel Parlby,
Brev. Lieut.-Col., late Bengal Artillery.

Percy-street, Bedford-square, Feb. 16, 1862.

Note.—Many experiments, attended with great expense, have been and are now making to produce cannon capable of throwing shot or shells weighing 300 lbs. or more. It would be very easy, and perfectly practicable, as I will undertake to prove, if means are furnished, to produce rockets from 500 lbs. to 1,000 lbs. weight, or upwards, requiring nothing but an earthen ramp to support them in their discharge, and capable of being thrown with equal exactness as shells from mortars. One of these rockets falling upon the deck of a ship would immediately disable, or destroy it. Samuel Parlby.

THE APPLICATION OF CHEMISTRY TO THE MILITARY ART.

Sir,—To the concluding part of Professor Seely's remarks, in his lecture, reported in the *Scientific American* of the 8th inst., I have made the following note:—Is not the interior of a ship very combustible, with its ropes, canvas, tar, hammocks, crinolines, &c., &c.? The late Lord Dundonald has declared that it is so. The Professor's six-inch shell, charged with molten cast iron, cannot be thrown to the distance of five miles and a-half; but an elongated shell, adapted to a two-inch bore rifle cannon, and charged with phosphorus dissolved in bi-sulphide of carbon, can. I ask, would a drop of molten cast iron, dropped on a man's finger, set it on fire? I am, &c.,

---

[*] The italics are mine.

J. NORTON.

Feb. 19.

REVOLVING RUDDERS.

3 Conway Place, Birkenhead, Feb., 1862.

SIR,—As there does not seem to be much progress made in any new mode of steering large steam ships, permit me to say a word or two with respect to my revolving rudder. I believe I was too sanguine when I stated that it would bring a vessel round if she were drifting with the tide; if, however, the vessel be making no headway, I believe it would be no better than an ordinary rudder, but on the other hand, I believe that a revolving rudder such as I have described, if it be of equal area, will bring a ship round in less than half the distance that an ordinary rudder would do. Your correspondents, Mr. Moy and Mr, Roberts, seem silent at present. I hope Mr. Moy has not got Mr. Roberts in a trough of the sea, and so put the brake on his propeller. I should very well like to hear of Mr. Roberts' screw taking another turn. I see in your number for January 13, Mr. Trotman has brought out a plan for steering by steam. I beg leave to say that eight years ago I submitted a plan to one of the principals connected with the building of the Big Ship, exactly the same as Mr. Trotman's, with this difference, I had no steel springs, and both of my cylinders were steam cylinders; and I intended that when the rudder was brought over, in order to be held in that position, I merely brought the slide valve into a position so that it admitted steam into the same ends of both cylinders and so locked the rudder; but, at the same time, should the rudder be struck by a heavy sea, the steam in the cylinders would act both as a brake and a spring-buffer. Last night a gentleman in the Spool Polytechnic read a paper, where he proposes using two squirts, one on each side of the stern of the Great Eastern, as a means of steering. Your obedient servant,

W. HETHERINGTON.

TURBINES.

SIR,—Would you or some of your readers acquainted with the subject, kindly inform me, whether in the case of using a Turbine (which is said to be much used in France and Germany, but which appears to be little noticed in this country, although possessing it is said, great advantages over every other form of water-wheel), first, supposing the water conveyed by a pipe one inch in diameter and having a fall of 100 feet to be equal to a power of four horses—would four pipes of the same diameter, each having a fall of 25 feet, be in effect of the same power? Again, would these four pipes if connected with a 10 inch cylinder, on the principle of the hydraulic press, such cylinder communicating by a four inch pipe with the Turbine, increase the power thereby?

Yours respectfully,

R. E. B.

Northampton, Feb. 17, 1862.

THE USE OF MECHANICAL HYPOTHESES IN SCIENCE.

SIR,—I have with much pleasure read Professor Rankine's paper upon the above-mentioned subject, which, as regards the cautiousness of its views, presents an agreeable contrast to the generality of the hypotheses of philosophers, some of them our best authorities, concerning molecules and molecular alteration. There is, however, one statement in it, which I am almost compelled to look upon as an oversight, and which, I think, has raised the surprise of every reader who has the smallest acquaintance with optics. I allude to the words, "the corpuscular or projectile hypothesis regarding light, is absolutely *disproved* by the fact of the less velocity of light in the more highly refracting media, which is contradictory of one of its necessary consequences." I am not aware that, by means of any trustworthy experiment, it *has* been shown that the velocity of light in passing through media decreases with their refractive powers, but, *if* this is the case, so far from being contradictory of one of the necessary consequences of the corpuscular hypothesis, it is the result of it, and therefore something in favour of its correctness. A [illegible] of light, according to this hypothesis, is something like a ball, the force of which is weakened in proportion to the directness with which it strikes any surface; now, an increase in indirectness of impact is in effect, similar to an augmentation of refractive power, and *vice versa*; and therefore, if the velocity of light is small in proportion to its amount, the hypothesis in question is agreeable thereto, and upheld by this circumstance. It has been supposed, from the phenomena of the production of coloured beams from polished metallic surfaces, that the angle of reflection is not in every case that of incidence, but no certain conclusion has, I think, been arrived at. Upon the undulatory hypothesis, whatever variety of motion may be understood, it is very difficult, and perhaps impossible, to imagine the equality of these angles, which may also be said of refraction generally.

I am, Sir, yours &c.,

J. ALEXANDER DAVIES.

February 18th, 1862.

Gossip.

Mr. Ricardo has given notice that he shall move for a Committee to consider the policy and operations of the patent laws.

We see that a drawing association for engineering, mechanical, architectural, and general drawing, &c., has been started under the management of Mr. Fred Young, at 7 Duke-street, Adelphi.

On the 5th of this month a trial took place at Shoeburyness with two cannon (68 pounder blocks bored to 32 pound size, and rifled on Mr. Jefferies' plan). Both guns burst on the same morning at about the 20th round; the charge of powder in this case was, we believe, 12lbs., and affords conclusive proof that where lead is used in large quantities on the projectile with anything like an approach to the old service charge of powder, the gun must inevitably burst from the jamming of the lead in the bore of the gun; on the other hand, if the projectile is thinly coated with lead, like Sir William Armstrong's, it flies off at a tangent on leaving the muzzle of the gun, or passes away in fumes on the explosion of the powder.

We understand that Mr. Chalmers, the author of "the Channel Railway," at the request of influential parties in Canada has been considering the feasibility of a railway communication across the St. Lawrence at Quebec by means similar to those which he proposes for crossing the English Channel at Dover. Mr. Chalmers believes that there are no insurmountable, or even very serious difficulties to be encountered, and that a substantial and durable roadway can be constructed on his plan for about one-fourth of the cost of the Victoria-bridge at Montreal.

From the thirty-first annual report of the United Service Institution just published, we find that since the last Report, the Council have received from the War Departments of the following European States, namely, Bavaria, Portugal, Russia, Saxony, Spain, and Sweden, as well as the United States of America, donations of arms, clothing, and field equipment. This collection now contains specimens of all the minute details which constitute the equipment of the soldier in most of the Continental Armies, as well as in that of Great Britain. The Council have purchased of Her Majesty's Government a Model, constructed by the Royal Engineers, illustrating the attack and defence of a Fortified Town, and other Models of an instructive character. A beautiful Collection of Models of various descriptions of Ordnance has been deposited in the Institution by Colonel Tylden, Royal Artillery. The Indian Government have presented a number of weapons taken in India during the mutiny and disarmament of the native population, consisting of matchlocks, swords, spears, daggers, shields, &c., forming a valuable addition to the Indian armoury, already in the Museum.

Mr. John S. Phené, who recently delivered a lecture on the Hartley colliery catastrophe at St. James's Hall, illustrated the action of carbonic acid gas with atmospheric air by experiments. Since the delivery of the lecture he has given the following details of the experiments. My apparatus, a glass vessel, represented the level of a mine with two vertical shafts; on dropping a cradle to the bottom of one of the shafts, I illustrated the operation of a furnace driving the air into the upcast shaft; after withdrawing my candle I charged the level of the mine with carbonic acid gas, which from its superior gravity retained its position at the bottom of the shafts, where it extinguished my candle on fresh insertion. I then caused a current of ventilation, which I suddenly suspended, by stopping the top of the upcast shaft, while still containing atmospheric air, just as the accumulated debris at Hartley stopped the furnace-drift. After a short interval the carbonic acid gas, having acquired momentum, displaced the air, and took its position at the top of the shaft, while the bottom of the shaft contained pure and lighter air, as was proved by my candle now going out at the top of the shaft. I infer from this that the current of ventilation, although suddenly suspended by the debris, caused the carbonic acid gas to ascend till arrested, as in a *cul-de-sac*, in the Yard seam and furnace drift; and that therefore, the miners sought of all others the most dangerous locality—running into the gas, in short, while endeavouring to escape from it; whereas had they avoided it a few hours longer it would probably have found its natural level again. In the position they took they would also unquestionably encounter the carbonic oxide from the furnace. Might not our miners be taught and drilled as our volunteers are, that they might know how to contend with their enemies when occasion arises?

Mr. James Bruce writes to say that attention ought, at the present moment, to be directed to the useful properties of the common nettle (*Urtica Dioica*). In Russia, many years since, excellent linen was made from it for shirts, sheets, and sail cloth. An excellent hemp may be obtained from it, by cutting it just before the seed is ripe, and steeping it in water, as they do hemp or flax, and manufacturing it in the same way. Excellent paper may be likewise made from it. The roots boiled with alum, will dye yarn a yellow colour. Every part of this plant, which is an obnoxious weed, might be turned to good account, as it possesses excellent medicinal properties.

Two small vessels, one of fifty tons and another of about twenty tons, have this week come down from Hasten Creek, and are now laying at buoys in Portsmouth Harbour, to which considerable interest may be attached. They have been fitted out by Mr. Cunningham the inventor of the well known "Cunningham method of reefing topsails from the deck," for the purpose of prosecuting a series of experiments on the rig of steam ships. The larger vessel is fitted upon a plan for obtaining as large a spread of square sails as at present exists with much greater simplicity of arrangement aloft, also a great reduction of running rigging, and a more extensive system of fore and aft sails in the shape of trysails than at present exists. The topsails are rolled up and set from the deck, thus affording the means of making sail in action without exposing men aloft. It is further anticipated that the yards will brace up nearly fore and aft when steaming head to wind. The smaller vessel is rigged in a very novel manner, the principle of which is that a powerful system of square sail is provided without the impediment of yards when steaming against the wind, and a large reduction of weight aloft is also effected, this too is accomplished with the provision of a complete system of trysails. We wish Mr. Cunningham well with his experiment; he has already conferred benefit on navigation by his invention for reefing from the deck, and the equipment now of this little experimental flotilla may further result in much public benefit.

At the last ordinary meeting of the Manchester Literary and Philosophical Society, Mr. Binney said that soon after the death of Professor Eaton Hodgkinson, F.R.S., one of the former Presidents of the Society, and a man of science, of whom not only that Society, but the city of Manchester, had good reason to be proud, a few of his friends and admirers gave a commission to Mr, Slater, the sculptor, of London, to execute a bust of the deceased, to be presented to this Society. As his valuable memoirs, which gave to the world the formulæ for solid and hollow pillars of cast iron, now the basis of calculation on all structures of that metal, were printed in their Transactions, it was thought that the Hall of the Literary and Philosophical Society was the fittest place for the bust of their discoverer. The following gentlemen J. P. Joule, LL.D., F.R.S., E. Schunck, F.R.S., James Heywood, F.R.S., John Hawkshaw, C.E., F.R.S., Joseph Whitworth, F.R.S., R. P. Greg, F.G.S., Thomas Turner, F.R.C.S., G. R. Stephenson, C.E., Robert Rawson, and E. W. Binney, F.R.S., are to present the bust to the Society.

According to the *Times* the operation of fixing the 12-inch and 8-inch teak planking to the sides of the armour-plated screw frigate Royal Oak, 51 guns, under construction at Chatham dockyard, is now completed, and preparations have been commenced for fixing the massive slabs of iron, which will encase the vessel from stem to stern, as soon as these have been received from the contractors, by whom they are at present being prepared. The vacant space on the eastern side of the slip on which the Royal Oak is building is now being converted into a large workshop, which will be covered in with a glass and iron roof, for the reception of the whole of the powerful machinery to be used in drilling, planing, shaping, and otherwise preparing the armour-plates and fixing them to the vessel's side. It was at first decided to bend all the plates cold, and a hydraulic machine sufficiently powerful to perform that operation, has been received from the firm of Messrs. Bailie, Westwood, and Campbell, but, as one machine will not be able to prepare the slabs of iron with the celerity required, a portion will be formed into shape hot, the necessary furnaces and machinery being built adjoining the shed under which the Royal Oak now lies. The defects in the Defence, Resistance, and some others of the iron ships in having only their broadsides plated with iron will be remedied in the Royal Oak, every portion of which will be encased in iron, the plates in the parts most exposed to shot being 4½ inches in thickness.

At the monthly meeting of the Franklin Institute, Philadelphia, in December last, Mr. Washington Jones, chairman of the committee on meetings, exhibited Amies' patent universal square, which combines five different instruments, viz: the try-square, the miter, the T-square, the graduated rule, and (what is entirely new) the centre square, for finding the centre of a circle. This instrument was made by J. R. Brown & Sharpe, Providence, R. I. He next presented, from the same makers, a centre gauge, for adjusting the work in a turning lathe. The same gentleman also exhibited a standard scale of hardened steel, graduated from ¼th to 1/100th of an inch by machinery, combining accuracy and cheapness. It was made by Darlington & Schwartz, Bangor, Maine. All the above tools where presented by Messrs. Field & Hardie, of this city. Mr. Jones also exhibited a razor strop, the invention of Mr. C. Y. Hayne, the polishing cushion of which is stuffed with sand, instead of lying flat on the body of the strop as usual. Mr. Howson, of the committee on meetings, submitted a watchman's clock, the manufacture of Messrs. Code, Hopper & Gratz, of this city. By means of this clock, it may be readily ascertained whether a watchman has remained at his post during the proper hours. A slit is made in the face of the clock, through which the watchman introduces a pencil at stated intervals to mark a revolving dial; the marks on the dial show the hours at which he has been at his post. Mr. H. also presented a great variety of paper tags and collars, both plain, printed in colors, and embossed, made by the Lockwood Manufacturing Company of this city. He also exhibited an apparatus, the invention of E. H. Bailey of this city, which may be readily attached to the lock of any door, to prevent the key being turned by nippers or other tools from the outside. Mr. Howson then placed on the table a working model of H. G. Armstrong's paper bag machine, as improved by S. E. Pettee; also a specimen of Photograph Album, made by Turner Hamilton. Specimens of envelopes made by a machine invented by Mr. Pettee were also exhibited by Mr. Howson. Envelopes made in this manner cost considerably less than those made by hand, and can be made at the rate of 30,000 per diem.

The *Times* of Wednesday last says the experimental firing from the wooden model of Capt. Cowper Phipps Cole's gun shield, built on the deck of the Hazard sailing sloop, commenced at Portsmouth yesterday, under the supervision of Capt. R. S. Hewlett, C.B., commanding Her Majesty's ship Excellent, Capt. Coles being also present. The day's firing was from one of the two guns with which the shield is fitted, and so far has been attended with the most satisfactory results; the concussion in the shield from the gun's discharge being very slight, and the smoke being drawn from the tower and shield almost instantaneously with the gun's discharge. The firing may probably extend over some days, to enable Cap. Hewlett and the inventor thoroughly to test the working of two 100-pounder Armstrongs within the base of a cone the diameter of which is but 15 feet (a base, however, which yesterday's firing apparently proves to be of quite sufficient diameter), and to discover any possible minor defects in the equipment of the heaviest calibred guns firing full charges with shot under such novel conditions as their working under cover of the shield involves. The experiments will be resumed, probably to-day, by firing the two guns simultaneously. Yesterday's firing placed the success of the double gun cupola, or shield, beyond doubt, and the greater portion of the future experimental firing will be, as we have already stated, a mere matter of practice, to render the whole as perfect as possible, and to enable the plans for the new shield-ship to be completed at once, which of course could not have been done while any doubt remained as to the space required for the towers and their shields.

A correspondent of the *Hamilton Times* writes from the oil springs, under date the 16th inst., an interesting account of a flowing oil well which has just been tapped. He says:—"I have just time to mention that to-day, at half-past 11 o'clock A.M., Mr. John Shaw, from Kingston, C.W., tapped a vein of oil in his well, at the depth of 158 feet in the rock, which filled the surface well (45 feet to the rock) and the conductors in the course of 15 minutes, and immediately commenced flowing. It will hardly be credited, but nevertheless, such is the case that the present enormous flow of oil cannot be estimated at less than 2,000 barrels per day (24 hours), of pure oil, and the quantity increasing every hour. I saw three men in the course of one hour fill 50 barrels from the flow of oil, which is running away in every direction, the flat presenting the appearance of a sea of oil. The excitement is intense, and hundreds are rushing from every quarter to see this extraordinary well. Experienced oil well diggers from the other side affirm that this well equals their best flowing wells in Pennsylvania, and they pronounce the oil as being of a superior quality.

Doubling Silk Threads.—We have just been informed of a highly important improvement which has been effected in the manufacture of three-cords lace and fringed silk, by means of a very peculiar system of doubling the threads, and of a machine adapted for performing this operation. This ingenious process originates with the house Beaux Mahistre and Rousset, of Avignon, who are successfully working the patent in France. A patent has also been taken out in England. Silk-throwsters generally, who are more especially interested in this improvement, will doubtless thank us for bringing it to their notice. The entirely fresh circumstances arising from the commercial treaties prevent our intelligent and active manufacturers from viewing with indifference the progress made in a neighbouring country, especially when that country is France, whose genius alone, perhaps, is able to compete with ours. The method, hitherto employed to double three threads silk cord consists in joining three threads previously twisted or spun, taken from three separate bobbins. If these three threads are not of precisely the same twist, and of precisely equal sizes, and also perfectly stretched, to obtain which is extremely difficult and almost impossible—great lengths without knots being the object in view—the consequence is that, instead of producing a smooth even thread, a faulty one is obtained, technically called "cork-screwy;" that is to say that, where these threads are not of equal size and tension, they do not join well together, and form an uneven surface, similar to the edge of a saw. The system of doubling of which the patent treats remedies these defects, by taking a single thread and doubling it into three, making a continuous chain, the loop composing the chain coming at distances of four or six feet more or less. It is easy to see that one and the same thread doubled on itself continuously in this way will be more equal in size and tension than a three cord silk produced from three different threads, and worked in great lengths. The operation of this patent, besides securing a good result from a comparatively inferior material, enables one to obtain indefinite lengths with no other knots than those which arise from the end of a bobbin, and from accidental breakage. It furnishes, moreover, an article free from "cork-screw," which hitherto has been the great difficulty in *cordonnets* of great length. The freedom from knots and "corkscrew," combined with evenness and length of thread, is a great advantage in certain processes of manufacture, more particularly so in the making of machine lace and cord for sewing machines, which are becoming more and more generally used. We understand the machine effecting the doubling alluded to is inexpensive, and is managed by one woman, without the aid of either steam or any other motive power. The quantity of work which can be accomplished by one machine varies from 6 to 10 lbs. per day, according to the size of the silk used.—*Nottingham Journal.*

The Progress of Meteorological Science.—Meteorology is a science that has engaged philosophers for centuries; but it is only since the discovery of the electric telegraph that they have been able to make simultaneously and transmit to head-quarters instantaneously the results of their labours over a wide field of observation. Since this has been done, immense strides have been made, and it is rapidly becoming an exact science. This system was first commenced by the Meteorological Department of the Board of Trade, in September, 1860. Thus the nation of shopkeepers has been the first to lead the world in a new and most important applied science, which must ultimately save the lives of thousands of sailors and boundless wealth to the merchants. The observers at the out-stations, which are all situated at seaports of the British island, are the telegraph clerks—a very intelligent set of men. The Board of Trade provides them with every requisite meteorological instrument, and provides a manual of instruction for their use. In this manner a staff of skilled observers are being drilled in all our important seafaring places. They are instructed to send reports to the central office in Parliament-street twice a day, at eight a.m. and three p.m., and oftener when any great disturbance of their instruments warrants special notifications, to Admiral Fitzroy. These telegrams give in symbolic figures the condition of the barometer and thermometer, wet and dry; the direction of the wind; the force of the wind; the amount of cloud; the character of weather, and the sea disturbance. Thus the chief is supplied, in a compact form, with all the leading features of the sum he has to work. When all the telegrams for the day have arrived, the various corrections for local peculiarities are made, and the condition of the weather is forecast. As the knowledge of circular storms is becoming more thoroughly known, the value of this daily sum worked at head-quarters is becoming of the last importance. It is now known that all great hurricanes move in cyclones or ovals, in northern latitudes, giving circling winds from left to right, but moving bodily from the south-west towards the north-east. These cyclones are of all sizes, and they move at a rate sufficiently slow to enable warning of their approach to be given to outports some time beforehand. The first well-noted cyclone was that known as the Royal Charter storm. This hurricane commenced in the south-west, about the Bay of Biscay, and finally passed off along the coast of Norway, sweeping on its way across this island, and visiting the west, south, east, and northern coast with gales which boxed the compass within twenty-four hours. The passage of this great storm has been most accurately mapped, and its whole course in every particular worked out in the most perfect manner, by Admiral Fitzroy and his staff of observers.—*Once a Week.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 1920, 1939.
Boilers and their Furnaces, &c., 1928, 1932, 1945, 1948.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1908, 1917.
Ships and Boats, including their fittings, 1926.
Cultivation of the Soil, including agricultural and horticultural implements and machines, *None.*
Food and Beverages, including apparatus for preparing food for men and animals, 1922, 1953.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1918, 1930, 1931.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1911, 1927, 1961, 1963.
Lighting, Heating, and Ventilating, 1909, 1910, 1912, 1915, 1916, 1923.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1906, 1913, 1914, 1926, 1940, 1941, 1946, 1949.
Metals, including apparatus for their manufacture, 1924, 1958.
Chemistry and Photography, *None.*
Electrical Apparatus, 1907.
Warfare, 1933, 1938.
Letter-Press Printing, &c., *None.*
Miscellaneous, 1905, 1919, 1921, 1929, 1934, 1935, 1936, 1937, 1942, 1943, 1944, 1947, 1950.

1905. A. Wood. *Improvements in refrigerating storehouses, and in other structures in which a low temperature is continually or periodically required.* Dated July 31, 1861.

This consists in the introduction into storehouses, or other localities wherein operations are carried on requiring a constant or periodical low temperature, of large masses of ice, or other refrigerating materials, which are enclosed in air-tight receptacles or chambers, situated by preference in the upper part of such buildings, and arranged so that they are effectually protected, by coverings consisting of thick layers of good non-conductors of heat, from the influence of the external atmosphere, whilst these receptacles are at the same time so arranged, that between these and the rooms to be cooled by them, there exists an air space or air spaces, enclosed by sliding shutters, trap doors, or such like arrangements, constructed of materials which are good non-conductors of heat, thus forming a reservoir or reservoirs of cold air, which cold air may at pleasure be let into the room or locality to be cooled by opening the sliding shutters, the warmer air inside the room or other locality taking its place and being refrigerated in its turn. *Patent completed.*

1906. J. F. Flanders. *Improvements in machinery for splitting, dividing, or shaving leather or skins, or sheets of manufactured fabrics.* Dated July 31, 1861.

This consists in an arrangement of mechanism whereby the leather, skin, or sheet to be operated upon is fed up to the knife or cutting instrument, and is supported during the cutting operation. *Patent completed.*

1907. J. Rylands, T. G. Rylands, and P. Rylands. *Improvements in joining wire for telegraphic conductors and other purposes.* Dated July 31, 1861.

Here, under one modification, the patentees twist together the ends of the iron wire (before galvanizing it) in the same manner as the ends of the galvanized telegraphic wires are commonly twisted together, that is to say, they twist the end of each wire in a spiral around an untwisted portion of the other wire, leaving a short space between the two spirals. They afterwards wrap a strip of iron or iron wire around in the space between the two spirals, and heat and weld it into a solid mass. The wire and joints may afterwards be galvanized in the usual manner.

Digitized by Google

1908. H. J. Walouck. *Improvements in machinery or apparatus for retarding and stopping railway engines and carriages.* Dated August 1, 1861.

This consists in applying the break, or the power by which the momentum of the railway engine and carriages is to be overcome, to a distinct intermediate rail or plate, placed between the ordinary rails of the railway. This intermediate rail or plate may be connected to the side rails by cross sleepers, or otherwise, or it may be fixed independantly of them. The object of applying the breaking power to a separate rail or plate is to relieve the rails on which the wheels run of the wear and tear caused by applying skid breaks on the rails, or by breaking the wheels. *Patent abandoned.*

1909. B. Browne. *An improved self-acting tap or apparatus specially adapted for lighting cigars.* (A communication.) Dated August 1, 1861.

This consists of a bent tube intended to be screwed against a wall. One end of this tube fits into a pipe through which gas or other illuminating fluid or liquid passes, and to the other an air-tight tube, two or three feet, long is fitted, to which is also fixed a small bent tube serving as the plug of a cock, and fitting into a hole in a piece of metal constituting the seat of the cock, the same being formed with an arm through the end of which a screw is passed, the point of which rests upon the beforementioned small bent tube, the said screw being employed to adjust the extent to which the opening in the cock is uncovered when out of use, or if necessary to close it entirely. A jet or small burner is forced into the top of the cock seat, and to the bottom thereof a handle is fixed. This apparatus is especially adapted for lighting cigars. *Patent abandoned.*

1910. H. Meaking. *Procuring a light in the form of an improved lucifer match and prepared paper for igniting the same.* Dated August 1, 1861.

Here the wood is first dipped in melted sulphur, and, when dried in a compound of chloride of potash in powder eight parts, sulphur one part, rottenstone four parts, lampblack one part, and gum two parts, with sufficient water to form a paste. The paper is to be coated with the following solution:—Amorphous phosphorus four parts, and graphite in powder one part, made into a solution by adding silicate of soda one part, and water four parts. The paper is to be coated with the solution by a brush. The light is obtained by drawing the match briskly across the paper. *Patent abandoned.*

1911. R. Harrison. *Improvements in apparatus for cutting slates and slabs.* Dated August 1, 1861.

This consists in cutting slates or slate slabs, laid upon a rest or fixed knife bolted firm to a frame, by means of knives or cutters fixed to the arms and placed in the plane of a wheel, and passing within a prescribed distance of the rest or fixed knife, according to the width of the slate to be cut off. The rotating knives extend nearly from the boss to the rim of the wheel. By giving a rotary motion to the wheel, the different knives cut off any or that portion of the slate held over or beyond the edge of the rest or fixed knife. A suitable gauge is used in connection with the beforedescribed apparatus. *Patent abandoned.*

1912. H. Shaw. *Improvements in wet gas meters.* Dated August 1, 1861.

This relates to the application to the meter of a reservoir or tank, for the supply of such additional water or other liquid as may from time to time become necessary, to make up for that which may be lost by evaporation or otherwise. The communication through which such additional supply of water or other liquid passes to the meter is by means of a valve or pipe, which may be opened as the water in the meter is lowered, and when the required supply from the reservoir or tank is admitted, such valve will shut. Within the meter the patentee places a float, in which he makes a valve seat of any suitable material (metal, wood, or caoutchouc); as the water in the meter is raised to its proper level, so will it float the valve seat to its shutting off any farther supply than what may be necessary. *Patent completed.*

1913. A. Powell. *Improvements in boots, shoes, and other coverings for the feet.* (A communication.) Dated August 1, 1861.

The object here is to make the seams or joinings hold more effectually. The inventor uses metallic rivets or studs for this purpose, and after passing the same through an aperture formed in the various thicknesses he clenches the same, so that a considerable portion of the material is clipped or secured between the rivet heads. Ornamental washers may be used on the said rivets. *Patent abandoned.*

1914. E. J. Muybridge. *Improvements in machinery or apparatus for washing clothes and other textile articles.* Dated August 1, 1861.

This machine consists of an oblong box or trough having vertical sides, and a sloping front inclined inwards at a suitable angle towards the bottom, the inner surface of the inclined front is corrugated similar to an ordinary washing board; or the corrugated surface may be made detatched, so as to be capable of being removed and inserted when required. The bottom of this box forms the segment of a circle, the centre of which is a point above the top of the trough, and almost vertical over the point of junction of the inclined front, and the curved bottom. There is an upright at each side of the trough, to which arms are suspended carrying a pounder or beater. These beaters are constructed of vertical slats, set at suitable distances apart, and having their front edge inclined and corrugated, the more effectually to retain and compress the fabrics under operation. Motion is given to the pounders or beaters so as to cause them to vibrate alternately by means of rods or levers connected to a crank mounted upon a shaft, which shaft is turned by a handle. A spigot or tap is provided for the purpose of drawing off the water.

1915. J. Cook. *Improvements in smoke-consuming furnaces.* Dated August 1, 1861.

This invention consists in forming an aperture through the bridge beneath the fire bars, and inserting in or fitting to the mouth of it a bent pipe, extending upwards at the back of the bridge to about the level of the top thereof, terminating by preference in an elongated mouth of or about the width of the bridge, but any other shaped mouth may be used. The inventor fits a valve to the pipe to regulate the draft. *Patent abandoned.*

1916. M. Pratt. *An improved mode of manufacturing candle moulds.* Dated August 1, 1861.

The patentee proposes to substitute for the ordinary metal moulds, candle moulds made of glazed earthenware. He prepares fine dry powdered clay in the way commonly practised in the manufacture of encaustic tiles, door furniture, and other articles, and moulds it by pressure between metal dies. *Patent completed.*

1917. G. Edwards. *A new system of traction for railways, tramways, and other roads.* Dated August 1, 1861.

This consists in the use of ropes for traction, the said ropes being placed parallel to the roads, and each with its ends joined so as to form an endless rope. The ropes are put in motion by any power or fixed engine. *Patent completed.*

1918. J. Wright. *Improvements in machinery to be used in carding cotton and other textile substances.* (A communication.) Dated August 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1919. R. Benton. *Improved motive power machinery or apparatus.* Dated August 2, 1861.

This consists in the use of two sets of balance bars, which the patentee calls major and minor bars; the major bars are formed with cranks at each end thereof, and have a movable weight within or upon each crank, and each weight being at least double that which is attached to one end of the minor bars. The whole of the apparatus is so arranged as to be in a perpetual state of equilibrium, except the weights attached to the end of the minor bars, and which said minor weights will be perpetually suspended on the descending side of the orb or axis to be kept in motion. Another part of the invention consists in dividing the orb or axis into sections, mounted on separate standards with minor driving wheels, whereby the power of each section or standard is communicated by chains or other convenient means to the main driving shaft, on which one or more driving wheels may be placed. *Patent completed.*

1920. F. W. Turner. *Improvements in apparatus for obtaining and applying the motive power of steam.* Dated August 2, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

1921. J. E. Drouot. *Improvements in kneading machines.* Dated August 2, 1861.

This consists in an annular kneading trough, supported and driven around a central support or column, which is also supporting the engine, and enclosing all the motive contrivances, radialing like from the centre towards every point where motion is required, and thus performing by a screw-shaped beater and a carrying fork the accurate imitation of manual kneading. *Patent completed.*

1922. W. E. Newton. *Improved machinery for cleaning rice, coffee, and other grains or seeds.* (A communication.) Dated August 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1923. E. Tomlinson and G. W. C. Wilson. *Improvements for facilitating the extinguishing of fires in warehouses and other buildings.* Dated August 3, 1861.

To apply this invention to, say, a warehouse, the inventors connect to an underground high-pressure watermain, or to an elevated reservoir, a supply pipe which is carried to the side of the warehouse, and about three or four feet above the level of the parapet, where it opens into a recess formed in the side of the warehouse, which may have a lock-up door. A suitable length of pipe is placed horizontally upon the head of the vertical pipe (forming a T shaped head), to which distinct branch pipes leading to each room or floor are fitted. These branch pipes are fitted within the lockup box with stop cocks and handles numbered correspondingly with the rooms above, and which, upon the discovery of fire may be turned on by, say, the policeman on duty, who is supplied with a key to the lockup box. The pipes may be placed along the ceiling in rows, or connected together by transverse pipes; these pipes are perforated with a large number of holes. *Patent abandoned.*

1924. G. Bish and J. Dredge. *Improvements in forming bends and other parts of non-metallic pipes, and in machinery or apparatus employed for such purposes, part of which improvements are applicable also to the formation of bends or curves in some kinds of metallic pipes.* Dated August 3, 1861

This consists mainly, 1, in the application of heat to pipes and tubes such as are manufactured from paper, canvas, linen, felt &c., for rendering sufficiently pliable to bend freely, and to be bent or moulded into any required form. 2. In a method of bending such pipes by means of a series of rings, the width of each of which (in a line parallel with its axis) is greater at one side of the diameter thereof than at the other, so that, when placed closely in contact, they assume of the curve or bend required. There are other features included. *Patent abandoned.*

1925. M. Merryweather and R. M. Merryweather. *Improvements in pumps, applicable to steam and other fire engines.* Dated August 3, 1861.

These improvements have reference, 1. To the position, and the arrangement of the parts of double acting horizontal pumps, and consist in placing both the suction and delivery valves in a chamber beneath the pump barrel, which the water enters and leaves at its extreme ends, so that any dirt or grit that may be drawn up with the water is ejected and prevented from injuring the pump barrel. 2. In surrounding a horizontal pump barrel concentrically with a cylinder communicating with the delivery outlet so as to form an air vessel for equalising the stream of water. 3. In an arrangement for lubricating the piston of pumps, by mounting on the piston rod two pistons with a space between them; this space being filled with oil continually lubricates the piston. 4 In the introduction into air vessels of flexible or elastic receptacles filled with air, by which means all the advantages arising from the elasticity of air will be obtained, while the absorption of air by the water will be prevented. *Patent completed.*

1926. J. Cross. *Improvements in fastenings for wearing apparel, and in the application thereof.* Dated August 3, 1861.

This consists essentially in using an elastic or other band with an ornamental clasp or fastening for tying up children's sleeves, so that by putting the band inside the sleeves of the under clothes, and bringing outside the sleeves of the outer clothes, and clasping or otherwise uniting the ends, the sleeves will be kept together. *Patent completed.*

1927. G. F. Jones and J. Jones. *Improvements in protecting and arranging water pipes, and in mechanical contrivances for withdrawing the water from the same and preventing their being injured by frost.* Dated August 3, 1861.

This invention relates, first to supply pipes. It being usually inconvenient or impracticable to place these sufficiently deep in the earth to be beyond the influence of frost, the patentees protect the same by coating them with, or embedding them in, some one or other of the substances which are the slowest conductors of heat (such as felt, straw, or hay bands, india rubber, fine dry sand, or sawdust, clay, salt, or alum), and when required, enclosing these in earthenware or wooden pipes or casing. Just where the protection due to depth ceases, the supply pipe is to terminate in a cylinder placed horizontally or obliquely, having a piston which, when pushed towards and left at the outward limit of its stroke, shall permit the free passage of the water from the supply pipe to the house main, and when drawn to its inward limit, and held so by a weight, shall stop and prevent the supply, at the same time permitting the water contained in the house mains and branches to return to the cylinder, and thence to run off by a waste pipe with a drain, which waste, during the admission of the supply, is closed by the periphery of a second piston open longitudinally, travelling simultaneously and commensurately with that first mentioned. *Patent completed.*

1928. C. Schinz. *Improvements in glass furnaces.* Dated August 3, 1861.

Here the fire grate forms part of a separate furnace, which the patentee calls the "gas regenerator," and this grate, which has an inclined position if intended for burning coal, is fed through a hopper. For the better production of the gases, as well as for their subsequent combustion, he injects atmospheric air by a fan into the gas regenerator from beneath, and heated air into the flue leading from the fire grate or regenerator to that part of the furnace holding the pot or pots, and the supply of air is so regulated as to furnish the exact quantity necessary to ensure the perfect combustion of the gases. From the regenerator the gases pass to the furnace holding the pot or pots or crucibles. The pots are of an oblong form, flat on three sides, and rounded at one, and at the corners. There are other details. *Patent completed.*

1929. G. L. M. V. de P. D'Amecourt. *An aerostatical apparatus called "aeronef or helicoptere."* Dated August 3, 1861.

The patentee claims imparting to aeronautical apparatus of a specific gravity exceeding that of the air, and by means solely of any prime mover, such as a steam engine or others, the ascending power required for causing the apparatus to rise in the air by the effect exerted on this latter by suitably revolving helixes, propelling blades, or vanes, or other mechanical arrangements, acting in so far in a contrary direction to each other as to cause the vertical components of their forces to unite their efforts for raising the apparatus, whereas the horizontal components keep each other in proper equilibrium, and thus prevent the apparatus from taking a giratory motion, whilst one or more revolving helices, propeller blades, or vanes, &c., are made use of for propelling, and one or more rudders, wings, or other devices for directing the apparatus. *Patent completed.*

1230. P. Haret. *An improved circular loom for weaving cloths of all kinds, either plain or ornamental.* Dated August 3, 1861.

This circular loom is composed of a cast-iron drum fitted on a vertical shaft; on a flange of the lower part of the drum rollers are fitted, over which runs a bevil toothed crown, actuated by a bevil pinion, which pinion keyed on a horizontal shaft, is caused to rotate by a hand crank. The warp need not be previously dressed for weaving. The threads forming this warp are wound on cops or spools turning freely on spindles, properly disposed in any required number outside, around a lower cylinder. The warp ascends from the cops up in the cast-iron drum; they are guided between small rollers, and each thread thereof passes into a little hole pierced through a small blade placed betwixt the teeth of two concentric circular combs; there are as many blades as threads in the warp. The revolving toothed crown carries a set of pinions which gear together, and one of them gears with a fixed toothed crown fitted at the top of the drum; this combined movement will impel the shuttle which runs round between the combs and over the thread guiding blades. The revolving toothed crown carries also properly shaped pieces, which, in their passage before and after the shuttle, drive the thread guiding blades inwards or outwards, causing the warp to be open or closed for the passage and setting of the weft thread. *Patent abandoned.*

1931. J. Henderson and J. Broadley. *Improvements in means or apparatus employed in weaving.* Dated August 3, 1861.

An extention of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

1932. P. O'Hanlon. *Improvements in marine and other steam boilers, with reference to economy of fuel.* Dated August 3, 1861.

The objects of this invention the patentee proposes to effect by two means, viz., on the one part by causing, through mechanical and artificial contrivances, a more perfect comfustion, and on the other part by conducting the water or feeding the boiler in such a manner through the flues as to become thoroughly heated, but without obstructing by such process any heat which would otherwise have contributed to the heating of the boiler. The more perfect combustion is secured by introducing into the mouth of each of the intermediary large tubes or flues (situated above the respective fire-boxes, and connected by those with a series of smaller tubes as described in the specification of the patent hereinbefore-named) a kind of fan or exhauster, which by virtue of the air or gases becoming more rarified on the one side than on the other by the heat, will rotate, and by so doing transmit the smoke in a regular way into the smoke-box of the boiler. *Patent completed.*

1933. J. Vavaseur. *A new transportable machine for rifling cannon.* Dated August 3, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1934. A. Prince. *Improvements in palate and tooth plates for dental purposes.* (A communication.) Dated August 3, 1861.

Here the air is made use of chiefly to form the organs of security to the plates out of the pituitary membrane, by causing portions thereof to pass through holes formed in the plates, thus fastening the same by means of button-like protuberances of the pituitary membrane, which are necessarily the result of the application to the pituitary membrane of these plates so provded with holes. *Patent completed.*

1935. W. E. Newton. *An improved process for producing colouring matters or pigments from manganese.* (A communication) Dated August 3, 1861.

This consists in the production of a green colour or pigment by the treatment of oxide of manganese. Protoxide of manganese is transformed into a crystalline transparent substance, and takes a very rich green colour and diamond like brilliancy when treated by the process described. *Patent abandoned.*

1936. J. Lewis *Improvements in producing and treating printing surfaces, in producing and preparing transferring surfaces, in transferring, in producing impressions on an altered scale, in preparing or treating surfaces of lithographic stones, and in obtaining devices or designs; also in agents and apparatus used in some of such improvements, parts of the invention being applicable to photography, and to ornamenting pottery, porcelain, and glass.* Dated August 3, 1861.

The specification of this invention is exceedingly elaborate, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed*

1937. F. Richmond, H. Chandler, and W. R. Ritchie. *An improved sack-holder.* Dated August 5, 1861.

The object of this invention is to retain the orifice of sacks distended while they are being filled. The improved sack-holder consists of a pillar or other fixing, to which is connected, by a set screw or other adjustable means, a bracket, in which are fixed the studs for two levers or arms, furnished at their lower extremities with holders to which the sack is suspended; the levers are coupled by toothed segments or other equivalent means, so that both are expanded or contracted simultaneously; one of the levers is provided with a ratchet segment into which a paul gears to hold the levers apart. *Patent completed.*

1938. C. Burn. *Improvements in the mode of fastening iron armour plates to ships' sides.* Dated August 5, 1861.

This consists in securing or fastening iron armour plates at the horizontal joints in the following way:—A bolt-like hole tapering inwards, that is, smaller at the inside of the plate than the outside, is made to extend equally from the joint into each plate, an iron plug tapered in like manner, is made to fit this bolt-hole, and a bolt made of wire or wire rope, endless or otherwise, passes round the same, thence through the side of the ship, and is secured inside by a key or wedge, by which it may also be tightened. In order that the plug may fit the bolt hole, and bear evenly on the plates, a groove is made therein for the reception of the wire bolt or rope. *Patent abandoned.*

1939. H. C. Meyer. *Improvements in slide valves, to regulate or stop the flow of water, steam, or other fluid.* Dated August 5, 1861.

The patentee claims, 1, the use of eccentric axles or eccentric bearings with wheels and rails. 2. The adoption of stationary axles of ordinary character with wheels and rods, forming a double joint on the slide and on the frame of the valve. 3. Elastic packing face double joint. 4. Metallic double-joint face. *Patent completed.*

1910. S. S. Fitch. *An improved chest expander.* Dated August 5, 1861.

This consists of a back-piece of canvas, &c., fitting to the back, and extending from the back as low as the hips of the person to which the expander is applied of suitable form for the purpose. To the lower part of this back-piece is attached a belt of elastic material encircling the abdomen for securing the expander to the waist of the wearer, which is fastened in front by buttons, &c. The effect of the use of this belt is to bring the back-piece to its proper position on the loins. On each side of the upper part of the back-piece is attached an elastic strap, which is passed over the shoulder, and terminating under the arm, is secured by buttoning or otherwise to the back-piece at a little below the centre of its depth, or other suitable position. *Patent abandoned.*

1941. E. D. Johnson. *An Improvement in the construction of centre seconds watches.* Dated August 5, 1861.

This invention relates to an improvement in the mode of fitting watches with both constant and independent seconds hands, the use of which, by showing a continuous progression of time, and also the duration and suspension of short periods of action of whatever kind, is well understood. The object of the invention is to simplify the mechanism required to operate the two seconds hands. This is effected by driving both the constant seconds and independent seconds of whatever kind by the same train of wheels and prime mover. *Patent completed.*

1942. J. Potter. *Certain improvements in the construction of straining pillars or posts, for wire or other strained fencing, and in the apparatus to be adapted thereto for straining or tightening the wires or strands.* Dated August 5, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1913. R. A. Brooman. *Improvements in locks and other fastenings, and in keys.* (A communication.) Dated August 5, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1944. F. Seiler. *An improved mode of overleaping differential levels, applicable to canals and to other purposes.* Dated August 5, 1861.

This invention consists, primarily, in the employment of compressed air, gas, or other like agent for raising and lowering boxes or chambers containing water for receiving boats, barges, and other vessels to different water levels, and it is particularly applicable to canals and rivers. The manner in which the inventor attains the desired object is as follows. He forms, say two reservoirs at different levels, and places in each a double box or chamber, open at bottom, and formed at top with a case for containing sufficient water to float whatever vessel may be required to be raised or lowered; they are also provided with swing gates, and are in communication with one another by means of a pipe provided with stop-cocks. To raise a vessel from the lower to the upper level, the chamber is caused to descend in the reservoir nearest the low level, so that the water therein may be on a level with it, and the vessel enters the chamber, the gates of which are then closed; compressed air is forced into the chamber, which rises until it reaches the intermediate water level; the vessel is then placed in the other chamber, and the compressed air allowed to return from the first to the second chamber, which raises the latter, and with it the vessel, to the upper level. To descend from the higher to the lower level, the reverse action takes place; vessels can by this means be raised and lowered in reverse directions at one and the same time, and without any loss of water. When once the compressed air is forced in, it may be used over and over again. *Patent completed.*

1915. M. A. F. Mennons. *Improvements in the grates of reverberatory and other metallurgic furnaces.* Dated August 5, 1861.

The patentee claims the substitution for the massive fire bars at present generally used in reverberatory and other metallurgic furnaces of a series of thin bars mounted on an oscillating frame, and arranged as described. *Patent completed.*

1946. J. D. Petit. *Improvements in the manufacture of watches and clocks.* Dated August 6, 1861.

We cannot here devote space to the voluminous details of this invention. *Patent abandoned.*

1947. M. A. F. Mennons. *An improved odontalgic elixer.* (A communication.) Dated August 6, 1861.

This consists in the preparation of a medicinal extract, applicable to the treatment of caries and other diseases of the teeth. This extract is obtained as follows:—To about ten quarts of cognac brandy are added cochlearia two and a quarter pounds (avoirdupois), milfoil, thirteen and a half ounces, pulverized cloves, one ounce, pulverized cinnamon, one ounce, pulverized cochineal, two ounces. The mass is left to infuse for fifteen days; after which it is filtered and completed by the addition of tincture of quinquina, ten ounces, concentrated essence of aniseed one and two third ounces, concentrated essence of mint, two thirds of an ounce. *Patent completed.*

1948. W. Galloway, J. Galloway and J. W. Wilson. *Improvements in steam boilers and in apparatus connected therewith.* Dated August 6, 1861.

This consists, 1, in an improved combination and arrangement of parts, forming a vertical steam boiler, wherein two or more sets or stories of tubes connected by water chambers are used, or can be introduced. 2. In applying two water chambers to the flues of horizontal boilers, with two furnaces, such water chambers being placed beyond and near the bridge. 3. In connecting a water bridge by vertical tubes to the upper part of the flue. 4. In applying glasses to the shell of the boiler, through one of which light is reflected, and through the other the interior of the boiler can be examined. 5. In applying a glass plate to the end of the boiler through which the level of the water can be seen. Lastly, in various improvements relating to safety valves. The invention is not described apart from the drawings. *Patent completed.*

1949. G. Potts. *Improved elastic steel mattrasses.* Dated Aug. 6, 1861.

In one modification of this elastic steel mattrass, a wooden frame is used for the under side, and upon this there are fixed a number of double cone spiral springs. Upon and attached to the springs there is arranged a framework, made of thin flat steel bands, and comprising an external frame connected by interlaced bands, arranged by preference dia[illegible] This system of interlaced steel bands provides for any pressure applied to one part, being distributed to and resisted by several springs, in consequence of which lighter springs may be used. *Patent abandoned.*

1950. R. Wappenstein. *An improved cop tube and cover for rollers used in spinning, and in apparatus for putting the tubes on the spindles.* Dated Aug. 6, 1861.

Here the patentee makes the cop tubes of any suitable fabric, woven tubular, which is first cut into lengths, then stretched on conical spindles of the required size, and afterwards coated with cement, gum, varnish, or other binding material. He also covers the rollers used in spinning machinery with similar fabric, woven tubular, and coats it with cement or gum. For putting the tubes on the spindles of a mule or other spinning machine he employs a frame, having in it holes or perforations for holding the tubes, the said holes being encircled with elastic material when desired. In order to keep the tubes firmly in their holes, he places in the interior of the frame a movable clipper, having holes or perforations corresponding with the holes in the frame. The tubes are passed through the holes both of the frame and clipper, and then, if the clipper is slightly moved, it will catch each tube, and hold it firmly whilst the frame is being carried about. The clipper is moved to and fro for tightening and loosening the tubes by an eccentric cam, crank lever, or other mechanical contrivance. The tube frame is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 8, 1861.

2512. I. Evans, Jun., Cefn Mawr, Ruabon, Denbighshire, collier. An improved miners' lamp.

Dated Nov. 7, 1861.

2797. T. Schwartz, New York, U.S. Improvements in the construction of air engines or air motors.

Dated Nov. 9, 1861.

2811. D. Cowan, Hungerford-street, Strand, manufacturer. Improvements in the construction of pneumatic subaqueous tubes for passenger or goods traffic, and in machinery for the manufacture thereof.

Dated Nov. 21, 1861.

2923. J. H. Jeffs, Tottenham-court-road. Improvements in the manufacture of collars, shirt-fronts, cuffs, hats, bonnets, vests, and other articles of wearing apparel.

Dated Dec. 2, 1861.

3023. W. P. Bain, Blackwall, doctor of medicine. Improvements in protecting ships' bottoms from fouling.

Dated Dec. 9, 1861.

3079. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improved natatory apparatus. (A communication.)

3080. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. A new or improved combination of microscopic photographs and lenses, with certain precious stones or imitations thereof. (A communication.)

Dated Dec. 21, 1861.

3205. T. Morris and R. Weare, Birmingham, electricians, and E. H. C. Monckton, Fineshade, Northampton, Esquire. Improvements in submarine and other telegraphic communication, and in apparatus connected therewith.

Dated Dec. 31, 1861.

3273. J. B. Cretal, Saint Malo, France, manufacturer. A new process of colouring smoking pipes.

Dated Jan. 6, 1862.

39. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. An improved manufacture of cigars. (A communication.)

Dated Jan. 8, 1862.

58. H. Cook, Manchester, gentleman. An improved mode of, and apparatus for, transmitting despatches and small articles by the agency of electricity. (A communication.)

Dated Jan. 9, 1862.

66. J. H. Tatum and W. J. Williams, New York, U.S. Improvements in the manufacture and structure of wicks, and in the application of the same to the manufacture of candles.

Dated Jan. 10, 1862.

78. L. Petre and E. S. Tucker, 194 Waterloo-road. The application of velvet, plush, cloth leather, American cloth, oil cloth, and other such like substances, alone and in combination with other materials, for advertising show boards, show cards, window tickets, and all such uses.

Dated Jan. 11, 1862.

81. T. Ramsay, Newcastle-upon-Tyne, coal owner. Improvements in the manufacture of coke.

Dated Jan. 14, 1862.

108. T. Harrison, Birmingham, foreman, and J. G. Harrison, Kirby Ravensworth, blacksmith. Improvements in ploughs.

Dated Jan. 15, 1862.

113. W. Cleland, 39 St. George's-hill, Everton, Liverpool. Improvements in treating and utilizing certain materials used and products obtained in the manufacture of gas, and in apparatus connected with the said treatment.

Dated Jan. 17, 1862.

123. T. Myers, 41 Bloomsbury-square, and E. Myers, 56 Millbank-street, Westminster. An improved composition for preventing rust on bright steel, iron, brass, or metal surfaces.

124. R. Dunlop, Cwn, Avon, Taibach, Glamorgan, accountant. Improved means for facilitating calculations.

Dated Jan. 20, 1862.

141. L. Barbat, 2 Rue Saint-Appoline, Paris. A new and improved fabric, applicable to the manufacture of hats, bonnets, and other like articles.

Dated Jan. 23, 1862.

169. J. Hinks, manufacturer, and A. Dixon, Birmingham, engineer. A new apparatus for warming and drying boots, shoes, or slippers, which apparatus is also applicable for racking or storing boots, shoes, or slippers, for exhibition or otherwise.

170 J. A. Mays, 30 Regent-square. Improvements in envelopes and other wrappers.

175. H. Owen, Albert-terrace, Islington, manufacturer. Improvements in the manufacture of stockings and other articles of hosiery.

Dated Jan. 27, 1862.

205. J. Lillie, Duke-street, Adelphi, engineer. Improvements in the method of protecting ships' bottoms from fouling, and in materials to be used therefor.

Dated Jan. 28, 1862.

214. H. H. Treppass, 14 St. George's-terrace, Barnsbury-park. Improvements in the construction, use, and employment of the kaleidoscope.

226. W. E. Newton, 66 Chancery-lane, C.E. Improvements in engines to be employed by pumping or forcing

air or water, or for other purposes where a rectilinear motion is required. (A communication.)

Dated Jan. 29, 1862.

231. F. D. de Boutteville, Fontaine-le-Bourg, Seine Inferieure, France. Improvements in machinery, applicable to the spinning of fibrous substances.

234. T. Meriton, 3 Leadenhall-street, engineer. Improvements in marine and other boilers for generating steam.

239. W. E. Newton, 66 Chancery-lane, C.E. Improvements in printing machinery. (A communication.)

241. G. Bedson, Manchester, manager. Improvements in wire fences.

Dated Jan. 30, 1862.

243. G. Phillips, chemist, and G. Phillips, rectifier and dealer in spirits, 89 Holborn-hill. Improvements in the distillation and rectification of alcohols or spirits.

244. M. Allen, 14 Worship-street, Shoreditch, builder. Improvements in the construction of buildings for the prevention of fire, and in the materials to be employed therein and therefor.

245. T. Gontard, 16 Rue des Vieux Augustins, Paris, physician. Improved truss plates, producing an upward pressure.

247. J. Firth, Heckmondwike, near Leeds. An improvement in finishing mohair cloth.

Dated Jan. 31, 1862.

253. D. Littlehales, japanner, Brearley-street West, Birmingham. An improved plastic compound as a substitute for papier mache.

255. J. Silvester, West Bromwich, manufacturer. Improvements in pocket and other spring balances.

256. F. Baggett, Birmingham, gun maker, and J. Sanger, Aston, near Birmingham, gun maker. An improvement or improvements in breech-loading small arms.

258. J Dodge, Little Portland-street, carriage builder. Improvements in C springs for carriages when used without a perch.

259. W. Walton, Manchester, and F. Walton, British Grove Works, Chiswick. Improvements in the manufacture of wire cards.

260. G. Mehrtens, 27½ Charles-street, Hampstead-road. Improvements in ladies' stays, and in the bodies of ladies' dresses.

261. J. Hargreaves, 12 Clifton-cottages, Clifton-road, Peckham. Improvements in the manufacture of pipes or tubes for conveying water, gas, acids, sewage, enclosing electric telegraph wires, and for other purposes, which improvements are also applicable to the manufacture of other vessels and articles, and in the machinery or apparatus connected therewith.

263. C. Pontifex, jun., 55 Shoe-lane, coppersmith and engineer. Improvements in apparatus for cooling or heating fluids or liquids.

267. A Forsyth, Glasgow, agent. Improvements in the manufacture of frames and in tablets used for advertising purposes.

268. C. Veronique, Rue Thaitbout, France, tailor. An improved wrapper garment.

Dated Feb. 1, 1862.

270. L. Fauvel, Paris, manufacturer. Improvements in apparatus for indicating the existence of escapes in gas tubing, and for stopping the continuance thereof.

271. R. Burkhardt and C. Doehler, Manchester. Improvements in æolian harps.

275. P. W. Daehne, Swansea. Improvements in furnaces used in the manufacture of zinc.

276. T. Cook, Coburg-road, Old Kent-road, machinist. Improvements in machinery for punching, cutting, and pressing metals and other materials.

277. J. Harris, Store-street, Tottenham-court-road. Improvements in mattresses, squabs, pillows, and other like articles of furniture.

278. T. Cook, Coburg-road, Old Kent-road, machinist. Improvements in machinery for folding envelopes.

280. F. Riesbeck, and W. Becker, Aldermanbury, manufacturers. Improvements in locks or fastenings for bags, portemonnaies, and other like articles having metal frames.

Dated Feb. 3, 1862.

282. L. Hill, Port Glasgow, shipbuilder. Improvements in applying armour plating to war ships.

284. C. W. Lancaster, Bond-street, gun maker. Improvements in strengthening cast-iron ordnance.

286. J. J. King, Chase Lodge, Lavender-hill, Wandsworth-road, cabinetmaker. Improvements in the fastenings of bedsteads, which fastenings are also applicable to other portable framework.

287. W. E. Newton, 66 Chancery-lane, C.E. Improvements in machinery for spinning. (A communication.)

Dated Feb. 4, 1862.

290. G. Manwaring, Southampton, engineer. Improvements in flushing apparatus for closets, sewers, and other water services.

293. J. L. Norton, 38 Belle Sauvage-yard, Ludgate-hill. Improvements in beating, stretching, and drying fabrics, and in the apparatus employed therein, part of which apparatus is also applicable for thrashing linseed. (Partly a communication.)

295. J. Greenwood, Portland Mills, Bradford, York, worsted spinner. Improvements in means or apparatus for preparing and combing wool and other fibres.

297. J. Webster, Birmingham, engineer. Improvements in gas fittings.

Dated Feb. 5, 1862.

299. D. Gallafent, 15 Stepney Causeway, engineer. Certain improvements in the mode or modes of generating or producing elastic vapours to be used as a motive power.

300. W. E. Taylor, Enfield, Accrington, cotton spinner and manufacturer. Certain improvements in carding engines.

301. J. King, Chadshunt, Warwick, farmer. Improvements in lubricators for lubricating the moving parts of machinery.

302. E. F. Smith, Dudley, Worcester, agent, and T. Swinnerton, Dudley, blast furnace manager. Improvements in the manufacture of coke, and in kilns or ovens for the manufacture of coke.

303. J. Browning, Minories, optician. Improvements in aneroid barometers.

304. H. Ashworth, Littleborough, manufacturer. Certain improvements in machinery or apparatus employed in spinning cotton and other fibrous substances.

305. E. Harrison, Oldham, schoolmaster. A certain compound or certain compounds to be used as a substitute for gunpowder.

307 J. Lee, Church Gate, Leicester, engineer. Improvements in traction engines.

308. J. B. Payne, Chard, Somerset, engineer and lace manufacturer. Improvements in the treatment or preparation of hemp, flax, and other analogous fibrous substances for spinning.

309. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. An improvement in fire-arms. (A communication.)

Dated Feb. 6, 1862.

310. C. Calow, Newton Heath, near Manchester, pattern maker, and J. W. Hirst, Manchester, machinist. Improvements in slide valves for steam engines and other similar purposes.

312. J. Pitkin, Clerkenwell, philosophical instrument maker. An improvement in aneroid barometers.

314. R. Shortrede, Brighton, colonel in Her Majesty's Indian army. Improvements in the construction of ships of war with armour plates.

316. M. Henry, 84 Fleet-street. Improvements in obtaining and applying motive power, and raising and forcing fluids, and in apparatus employed therein. (A communication.)

318. E T. Bellhouse, Manchester, engineer, and W. J. Dorning, engineer. Improvements in the construction of hydrostatic presses, suitable for packing and compressing cotton and other materials.

320. J. Tonkin, Pool, Cornwall. Improvements in the manufacture of gunpowder.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

357. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in smoothing irons. (A communication.) Dated Feb. 11, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2488. J. Edwards. Buttons.
2505. J. C. Willshee. Thrashing and dressing machines.
2507. W. Catford and J. S. Wheatley. Bobbin, net, or twist lace.
2510. W. Simpson. Twist lace machines.
2512. I. Evans, jun. Miners' lamp.
2514. R. W. Sievier. Batteries.
2516. W. Smith. Measuring and regulating the pressure of gas.
2525. T. Tidmarsh. Artificial manure.
2530. W. Mould, J. Hall, S. Cook, and W. H. Hacking. Looms.
2532. J. Stevens. Connecting and adjusting crinolines.
2534. B. Browne. Spring. (A communication.)
2541. R. Richardson. Railway fastenings.
2544. N. Stram. Watches.
2545. J. Clark. Electric telegraph apparatus.
2552. H. Nelson. Punching washers.
2559. H. J. Distin. Musical wind instruments.
2561. B. Taylor and C. Edkins. Dress-suspenders.
2562. F. B. Houghton. Manufacture of pulp paper.
2565. C. Wynants. Chase for printing presses.
2567. W. Ross. Taps or valves.
2572. R. A. Brooman. Plates for the table. (A communication.)
2574. T. Forster. Reworking waste vulcanised india rubber.
2579. J. Lister and D. Myers. Hoisting apparatus.
2584. W. Welch. Marine screw propellers.
2610. T. Lepeinteur. Fastening for gloves.
2611. T. Fearnley. Steam hammers.
2621. C. McDougall. Materials used for crinolines.
2625. F. A. Calvert. Engines.
2636. J. S. Phillips. Propulsion of vessels.
2666. R. A. Boyd. Singeing pigs.
2700. G. M. Gilbert. Preparing blue colour.
2877. E. Loomes. Moulding bricks and tiles.
3146. W. R. Rogers. Constructing dovetail joints.
61. J. Brunt. Gas meters.
191. J. Alison. Tilling land.
207. R. Martindale. Lamps.
234. T. Meriton. Generating steam.
243. G. and G. Phillips. Distillation and rectification of alcohols or spirits.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Feb. 14, 1862.

2058. W. H. Smith.
2060. W. Firth.
2061. T. Pedrick.
2064. A. S. Rostaing.
2066. H. Emes.
2069. S. Whitaker and R. Jones.
2092. T. Grahame.
2107. A. B. Childs.
2132. E. Peltier.
2162. J. S. Matthews.
2169. W. Hensman and W. Hensman, jun.
2201. W. E. Newton.
2261. J. Bowns.
2287. M. A. F. Mennons.
2453. A. Wyley.
2607. J. Webster.
2665. J. McCall and B. G. Sloper.
2725. W. Cook and H. Cook.
2900. G. Parry.
3031. G. T. Bousfield.
3121. W. Bell.

Sealed Feb. 18, 1862.

2057. E. S. Cathels.
2067. R. A. Brooman.
2071. J. Somerville.
2075. F. Gye.
2086. N. Salamon.
2089. J. M. Murat.
2098. J. H. Johnson.
2100. L. M. Casella.
2108. S. Elson.
2114. M. Hyams.
2120. R. W. Jones.
2159. A. Jaillie.
2168. W. Clark.
2185. W. Clark.
2223. M. A. F. Mennons.
2224. M. A. F. Mennons.
2234. M. Henry.
2258. L. P. Barre.
2951. G. Lowry.
2961. A. V. Newton.
3005. J. A. du Labaume.
3013. W. H. Balmain.
3047. A. T. Carr.
3098. W. E. Newton.
3153. G. Davies.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

401. G. Betjemann, G. W. Betjemann, and J. Betjemann.
404. H. Gardner.
408. J. Parkinson.
412. J. L. Clark.
435. J. J. Russell.
439. J. Breeden.
427. R. Cookson and C. W. Homer.
440. J. Eason.
445. P. E. Fraissinet.
446. T. Cattell.
451. C. Garton.
468. G. Paul.
505. J. H. G. D. Wagner.

PATENT ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

355. S. B. Weight and H. T. Green.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Feb. 15, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1702	0 10	1715	0 7	1728	0 3	1741	1 4	1754	0 [illegible]	1767	0 10
1703	0 2	1716	0 3	1729	0 3	1742	1 4	1755	1 1	1768	0 3
1704	0 3	1717	0 3	1730	0 3	1743	0 5	1756	0 [illegible]	...	...
1705	0 5	1718	0 10	1731	1 7	1744	1 9	1757	1 [illegible]	...	...
1706	0 8	1719	0 3	1732	0 3	1745	0 3	1758	0 [illegible]	...	...
1707	0 2	1720	0 6	1733	0 11	1746	0 3	1759	0 3	...	...
1708	0 8	1721	0 3	1734	0 3	1747	0 3	1760	0 [illegible]	...	...
1709	0 3	1722	0 3	1735	0 10	1748	0 3	1761	1 1	...	...
1710	0 [illegible]	1723	0 6	1736	0 3	1749	0 3	1762	[illegible]	...	...
1711	0 [illegible]	1724	0 3	1737	0 3	1750	1 7	1763	0 3	...	...
1712	1 2	1725	0 9	1738	0 3	1751	0 8	1764	0 2	...	...
1713	0 3	1726	0 3	1739	0 5	1752	0 9	1765	0 [illegible]	...	...
1714	0 6	1727	0 3	1740	1 4	1753	0 3	1766	[illegible]		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Feb. 20, 1862.

		£ s. d.		£ s. d.	
IRON:					nett
Rails in Wales and North of England	pr. ton	5 5 0	to	0 0 0	–
Welsh Bars, in Wales	,,	5 5 0	,,	5 7 6	–
Staf. Bars, at the Works	,,	5 10 0	,,	7 5 0	–
,, Hoops	,,	7 10 0	,,	8 0 0	–
,, Sheets, Singles	,,	9 0 0	,,	9 0 0	–
,, Nail Rods	,,	5 15 0	,,	6 10 0	–
,, Boiler Plates	,,	8 0 0	,,	8 10 0	
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 8 0	,,	0 0 0	nett
Do. No. 1, Good Brands	,,	2 11 0	,,	2 15 0	–
Scotch Bars	,,	7 5 0	,,	7 15 0	–
Swedish Bars, in London	,,	10 10 0	,,	11 0 0	
COPPER:					3
Sheet and Sheathing	per lb.	0 0 11	,,	0 0 0	–
Tough Cake and Tile	pr. ton	93 0 0	,,	0 0 0	–
Best Selected	,,	101 0 0	,,	0 0 0	–
Australian	,,	99 0 0	,,	0 0 0	–
South American	,,	0 0 0	,,	0 0 0	2½
Yellow Metal Sheathing	per lb.	0 0 9¼	,,	0 0 0	
STEEL:					2½
Swedish Keg	pr. ton	15 0 0	,,	0 0 0	–
,, Faggot	,,	16 0 0	,,	0 0 0	
TIN:					3½
English, Block	p. cwt.	6 1 0	,,	0 0 0	–
,, Bar	,,	6 2 0	,,	0 0 0	net
Foreign, Banca	,,	6 4 0	,,	0 0 0	–
,, Straits	,,	5 17 0	,,	0 0 0	
TINPLATES:					3
Charcoal, I.C.	pr. box	1 7 0	,,	1 9 0	–
Coke, I.C.	,,	1 1 6	,,	1 4 0	
LEAD:					2½
Pig, English	pr. ton	19 10 0	,,	20 0 0	–
,, Spanish	,,	19 0 0	,,	19 10 0	–
Common Sheet	,,	21 10 0		22 0 0	
Tea ,, [Wimshurst's Patent] A special disct.	,,	35 0 0	,,	0 0 0	–
SPELTER:					nett
On the spot	,,	18 0 0	,,	0 0 0	
For arrival	,,	18 5 0	,,	18 7	
ZINC:					
English Sheet	,,	26 0 0	,,	0 0	
QUICKSILVER	pr. btl.	7 0 0	,,	0 0	

JAMES LAURIE, Metal Broker.

10 Old Jewry Chambers E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 28, 1862.

THE STEERING OF SHIPS OF WAR.

Practical experiments continue to demonstrate yet more and more palpably the fact, that the present mode of steering our large war steam ships is totally inefficient. The rudder and tiller have enjoyed a very lengthened tenure of office, but their days are now numbered. It is quite possible, however, that before they receive their *coup de grace*, we may be called upon to record the occurrence of some fearful disaster to one or other of our armour-plated ships. In this country it seems to have become a rule that nothing short of lessons taught in the stern school of experience, are to be learnt by the governing powers.

It has been seen, for example, over and over again, even in trial-trips, in smooth water, and under the most favourable circumstances in other respects, that our Warriors, Black Princes, and Defences, are by no means sufficiently under control. The knowledge thus gained ought to have induced the Admiralty to cast about in all promising quarters for a remedy for the defect; but this they have not done. "My Lords" know well enough, that the ships in question are, so far as their steering arrangements are concerned, at the mercy of every adverse current or contrary wind; and although Lord Clarence Paget endeavoured, lately, to prove that the Warrior had behaved well during her voyage to Lisbon, reliable information from other quarters asserts that she frequently "laboured in an extraordinary manner, and in nine cases out of ten "took no notice of her helm." Assuredly no worse defect than the last-named could possibly exist in regard to a ship of war. The fatal effects of depending upon inadequate steering apparatus, were painfully exemplified in the disastrous loss of the Prince in the Black Sea, during the Crimean War, and more recently in the wreck of the Royal Charter, on the Welsh coast. If the ill-fated Prince could only have been kept head to wind during the gale in which she foundered, we assuredly should not have had to regret the occurrence of that catastrophe. The Royal Charter became unmanageable, and was lost from a similar cause.

Of the Great Eastern's most recent disaster we have before spoken, when treating of this subject; but it should not be forgotten that to defective steering arrangements that disaster was entirely due. Several of the Peninsular and Oriental Company's boats too have met with serious mishaps, and sustained great damage, from like causes.

The proposition that, if the bow of a vessel cannot under any and all circumstances be kept in the right position, the steering apparatus *must* be at fault, is so palpably true, that it seems needless to occupy space here by putting it. Still the fact does not, as yet, appear to have impressed itself with a proper degree of force either upon the Board of Admiralty, or the directors of great steamship companies.

To us it seems abundantly plain, and we refer for confirmation or refutation to practical seamen, that while the bow of a steamship is driven about, and out of its course, the power of the engines is calculated to propel the vessel in the very direction in which she is *not* wanted to go. Take the case of the Warrior for illustration. That magnificent and costly ship of war takes, under ordinary conditions, nineteen minutes in going about. Is it not clear that all the time this operation is in course of performance, she is drifting to leeward? It *has* happened to the same ship that she could not be got about at all, and that those in charge were obliged to "wear" her, thus turning her immense length, and bringing her up on the other tack. By this latter movement, at least a mile of ground would be lost. If this has occurred when there was plenty of sea room, how would it be with her when in the vicinity of a lee shore? Is it not too probable that she would become a wreck? We are by no means alarmists in regard to our new iron-clad ships, but we do desire to see a proper application of the practical and scientific skill of the country to the end that they may be made not only impregnable batteries, but, humanly speaking, independent also of the elements. As we have said, up to the present time each new ship of the class proves more and more the inefficacy and hopelessness of the present mode of steering. None of the new-fangled yokes or tillers answer, and we feel assured that little can be done in the way of amending or modifying the existing rudder arrangements.

The only efficient remedy will be found in some entirely new arrangement, and we advise the Government to seek for it without further waste of time.

There is no doubt that one of the main causes of screw steam-ships not answering their helms, lies in the fact that the propeller and the rudder are too near neighbours. This operates very disadvantageously when the ship is under steam, but it also has its evils when she is under canvas. The greater the length of the vessel, the more serious the consequences arising from the contiguity of rudder and screw. It may seem unnecessary to multiply the defalcations of the rudder system of steering, but there is another point in connection with it which we are loth to pass over. It has become a common remark that the results of trial trips of screw-steamers are no safe criteria of their subsequent performances. Nineteen times out of twenty we venture to say that the remark will be found truthful. Why is this? At the "measured mile" one course only is steered, and the rudder is perhaps not moved, whereas, in going from port to port the case is very different. Under the latter circumstances the rudder is seldom or never at rest. What is the inevitable consequence? The rudder is frequently brought across the ship's course, and a material retardation of speed follows. Screw steam-ships, it is admitted, make more lee-way than any other description of vessels. The falling away of the stern for the accommodation of the propeller has much to answer for in this respect doubtless, but the rudder is the great delinquent.

Having now drawn up our bill of indictment against the rudder and its auxiliaries, it may be asked what, in case of condemnation, do we propose to substitute for them? This question is a very pertinent and proper one, but as yet we are not disposed, nor in fact quite prepared, to answer it. The first step towards the reformation is the making it plain and conclusive that it is needed. This, we trust, we have done, and it is for those who have the talent and the opportunity to set themselves to work in devising the most simple, and the most effective plan for steering ships of war.

It is some months since we threw out some suggestions in regard to improved means of steering ships. These suggestions have, as our columns have subsequently shewn, not been disregarded. Several able correspondents have thrown themselves into the breach, and have come forward with valuable practical propositions, well worthy the consideration of the Admiralty and the public. Much depends upon actual experiment, however, and it can scarcely be expected that the cost of this shall be borne by private individuals. We shall be glad to see Government offering some encouragement to those who are willing to devote their ingenuity to the solution of the ship-steering problem. That solution we trust may be arrived at without waiting for the impulse communicated by the recurrence of another maritime disaster.

SIR WILLIAM ARMSTRONG AND CAPTAIN HALSTED.

Sir William Armstrong may consider himself a privileged person, for his name appears more frequently in our pages than that of any one else, and certainly more of our space is devoted to a consideration of his system of artillery, which he, by surpassing ingenuity, has induced the Government to adopt, than to any other question. Honestly believing that this system is an unsafe one, that the resources of the State are sadly misappropriated by its adoption, that other better and cheaper systems might, with advantage, be established, we shall continue to give prominence to this controversy until a Commission of Inquiry or some impartial and competent tribunal, pronounces an authoritative opinion on it. Up to the present time Sir William has had pretty much his own way. He has got a Select Committee after his own heart, he possesses avenues to the public and leading journals of the country; he has the willing ear of Under Secretaries of State; he is the Engineer of rifled artillery, and the Superintendent of the gun-producing department at Woolwich and at Elswick; he has the public purse open to him, in which he can dip almost as deeply and almost as frequently as he likes to try experiments for improving and perfecting his guns; he is, in fact, Inventor, Superintendent, and *quasi* Manufacturer and Contractor, as Captain Halsted calls him. We have, therefore, in Sir William Armstrong, to deal with no ordinary man. He is a clever lawyer, an adroit diplomatist, and an able tactician. Hence his success. But we are bold to say that that success is built on a rotten foundation. Sir William may mesmerise the Select Committee, he may administer soft sawder, &c., to Sir Ben Hawes, he may cajole Under Secretaries to become his advocates, and last, though not least, he may open the columns of the *Times* to himself, and close them to his opponents; but he can neither destroy facts nor alter the laws of nature. While facts, and the laws which produce facts, are against him, he, with his many auxiliaries, is in reality weak.

Our readers are aware that three or four months since, some articles, which appeared in the Mechanics' Magazine were reproduced in the *Times*. Sir William Armstrong condescended to treat those articles with something like contempt. Captain Halsted then wrote an able letter to the *Times*, which not only confirmed almost all we said about the Armstrong gun, but gave some additional facts. After six weeks' preparation, Sir William sent a long, elaborate, and special-pleading reply to the same journal, in which the Mechanics' Magazine and Captain Halsted were professedly answered. As the larger portion of the reply was devoted to Captain Halsted, all interested in the question—and they are a very numerous body—waited anxiously for Captain Halsted's rejoinder. Weeks and months passed away, and no rejoinder appeared. People naturally thought that Captain Halsted had considered himself defeated, or that some other reason induced him to drop the controversy. They who thought so were mistaken.

Captain Halsted wrote to the *Times*, and *his letter was refused insertion.*

We consider that Captain Halsted, and the public through him, have, in this matter, been unfairly dealt with. Why give insertion to Sir William Armstrong's letter of four or five columns length, and refuse the same privilege to Captain Halsted? Is there not something like favouritism here? There are many reasons why the gallant Captain should have met with courtesy and fair play from the leading journal. Captain Halsted is not a rival inventor. He has no wish to supplant an opponent. If there is a true-hearted and disinterested man in the naval service, that man is Captain Halsted. His industry is untiring, his ability is conspicuous, and his honour is unimpeachable. We should say the same of him were he our controversial adversary. Many accusations made against him by Sir William Armstrong rendered it necessary that he should justify what he had written in the eyes of the public. The non-appearance of his letter in the *Times* naturally became the subject of comment among his brother officers and his friends. They, or many of them, no doubt, supposed that he was unable to substantiate his statements, and he thereby must have suffered in their estimation.

There is another reason why Captain Halsted's letter should have appeared in the same organ of opinion which contained Sir William Armstrong's letter. Captain Halsted does not receive two thousand pounds a year, and money to any extent to make experiments and collect information, like Sir William Armstrong. No, he has to collect facts, as he best may, at his own expense, with all the legitimate avenues of knowledge closed against him. Every conceivable impediment is thrown in his and other people's way, who are desirous of informing themselves on the vital question of the country's defence. Sir William Armstrong may go where he likes, order what he likes, employ whom he likes, and, of course, say just as much or as little as he likes. All official documents—unpublished documents it should be remembered—are accessible to him, and he has the privilege of extracting from them what suits his purpose, and, of course, suppressing what tells against him. These documents are a sealed book to Captain Halsted. If an experiment issues in success, the fact is blazoned to the world through the public papers; but let a dozen experiments end in failure, and anything is done to throw over them the pall of silence and oblivion. As Sir William Armstrong is an interested person in every acceptation of the word, and as Captain Halsted is influenced only by the purest of motives; as Sir William has wind and tide in his favour, and as Captain Halsted can only in the face of disadvantages pick up fragments of information, we think the *Times* in this matter should have been more generous and just, and as it had given Sir William's lengthy reply, it should have extended a similar indulgence to Captain Halsted. It cannot be said that Captain Halsted is discourteous or personal. While Sir William is, according to Captain Halsted, "personal, uncourteous, and more or less "offensive up to the point of impugning my "veracity."

Captain Halsted, in his letter to the *Times*, complaining of the partiality showed by that journal to his opponent, makes an observation which is vitally suggestive. He says:—

"As one of those liable, if not likely, to be "called on, as you say, conclusively to test the "merits or defects of this imperfect experiment "by the irresistible logic of facts obtained in "active service, perhaps before an enemy, I "openly confess that I for one instinctively "shrink from such a responsibility; and my "letter which you withold was designed, and I "believe fully calculated, to prove before the "country that this invention is as yet so seriously "imperfect, that neither men nor officers, at "least of my profession, ought to have imposed "on them the responsibility of a forced reliance "on it for either victory or defence."

We know of other officers who entertain a similar fear as that expressed by Captain Halsted; and we have been informed that this fear prevails to a considerable extent in the naval profession. If this be so, then something should be done, without a moment's delay, to remove these apprehensions, either by proving that the Armstrong gun is a safe and reliable national weapon, and that the objections to it have arisen from misapprehension, or by withdrawing the gun from the service and pensioning its inventor. This can only be done by a Commission of Enquiry—which we have so long solicited. The *Times*, in a leading article on the 9th of October last, said, "We do not see "how it can be denied that the present dissentients have made out a case of enquiry— "and that enquiry ought neither to be delayed "nor stifled. It is of the utmost importance "to us that we should know the whole truth "about the Armstrong gun, and this truth we "shall never know until this gun has been subjected to every necessary test, without prejudice, favour, or reserve."

Captain Halsted, as he considers, being denied fair play in the *Times*, has published the letter, in an extended form, in a pamphlet. We regard the letter as a complete answer to Sir William Armstrong's allegations, and we are sorry that our limited space will not permit us to wholly reprint it in our pages. We shall, however, reproduce the whole of the second part of the letter, as that part bears more particularly on the general character of the Armstrong gun.

BLASTING BY GUNPOWDER.

In "Rankine's Civil Engineering" are to be found some of the most recent and approved data in respect to the above subject; and, as it is one of much practical importance, we do not hesitate to transcribe some of the Professor's remarks thereupon. The processes of blasting with gunpowder may be divided into *small blasts* and *great blasts.* A small blast is made by boring with a "jumper," a hole in the rock to be operated upon, and whose diameter may vary from one inch to six inches or thereabouts, and its depth from one foot to thirty feet. Part of the depth of the hole is filled with coarse-grained gunpowder, poured in through a tube reaching nearly to the bottom, and the remainder of the hole is rammed with what is called "tamping," consisting of chips of rocks, sand, clay, and other materials; the best material perhaps being dry clay. Care must be taken never to use any material which may strike fire, and not to ram hard until there are some inches of substance between the tamping-bar and the gunpowder. The fuse may be protected by traversing a tube, or a groove in a piece of wood. It should burn at the rate of about two feet per minute. The best fuse for this purpose is known as "Bickford's."

The explosion of powder, if the preliminary arrangements be properly made, splits and loosens a mass of rock whose volume is approximately proportional to *the cube of the line of least resistance,*—that is in general of the shortest distance from the charge to the surface of the earth—and may be roughly estimated at *twice* that cube; but this proportion varies much in different cases.

The proportion of the weight of rock loosened, to the weight of gunpowder exploded, ranges from about 7,000 : 1 to 14,000 : 1, and may be taken on an average at 10,000 : 1. The ordinary rule for the weight of powder in small blasts is:—

$$\text{Powder in lbs.} = \frac{(\text{line of resistance in feet})^{3}}{32} \quad \cdots(1.)$$

A test of the strength of blasting powder is that two ounces, or one-eighth of an avoirdupois pound of it, being fired in an eight-inch mortar, elevated at an angle of 45°, should throw a 68 pound ball to a distance of 240 feet. Another test is made by firing two ounces of powder in the "Eprouvette Gun." Its bore is 27·6 inches long, and 1¾ inches diam., it weighs 86½ pounds; it is hung in a frame like a "ballistic pendulum," and its recoil is measured on a graduated arc. Good powder fit for blasting gives a recoil of about 20 degrees. One pound of powder in a loose state occupies about 30 cubic inches. By compression it may be squeezed into 27½, or thereabouts. Thirty cubic inches being equal to 38·2 cylindrical inches; and this is the length of hole one inch in diameter, required to hold one pound of powder. The corresponding length for other diameters varies inversely as the square of the diameter.

A blast acts most efficiently when the line of least resistance is perpendicular to the axis of the bore-hole. . . . . If a charge fails to explode, the tamping may be bored out, a new fuse put in, and the hole re-tamped. This process is not free from danger, and a safer plan is to "jump" a new hole near the first, and put in a fresh charge of powder, the explosion of which will be probably communicated to the former charge.

A *great blast* is made by excavating a vertical shaft, or a horizontal heading, in the mass of rock, and which should turn at right angles at least once on its way to the powder-chamber at its end, in order that the tamping may not be blown out. Such shafts and headings vary from 3½ feet square to 3½ feet by 5 feet, or there-abouts, and the labour required to make them varies from two days' to six days' work of a miner per lineal foot. The mine being swept out, and its floor covered with a matting of old sacks, the gunpowder is placed in the chamber in a deal box, whose size is regulated by the fact before stated, that 1 lb. of powder fills about 30 cubic inches, a small quantity of finer powder in a bag or case forms a "bursting charge," and is traversed by a fine platinum wire connecting a pair of copper-connecting wires with each other. These are coated with india-rubber or gutta-percha, or otherwise insulated and protected, by being placed in a groove in a wooden bar. The entrance of the chamber is closed by a wall of turf, and the rest of the mine "tamped" by being built up either with rubble masonry, or with a mixture of stone and clay. When the workmen have removed to a safe distance, the conducting wires are connected with the opposite ends of a galvanic battery, when the electric current raises the platinum to a white heat, and fires the charge. The chief use of the electrical apparatus, it may be observed, is to fire several charges at the same instant. When one charge only is to be fired, a safety fuze may be used. In great blasts, the proportion of the weight of the rock loosened to that of the powder exploded, ranges from 4,500 : 1 to nearly 13,000 : 1, and is on an average 6,000 : 1, or 7,000 : 1. The ratio of the number of lbs. of powder to the cube of the number of feet in the line of resistance ranges from 1 : 32 to 1 : 10, but the best mode of fixing the quantity of powder is to estimate roughly the weight of the mass of rock which is likely to be loosened, and use from $\frac{1}{2}$ to $\frac{1}{3}$ of a lb. of powder for each ton of rock. In choosing the position of bores and mines for blasting, regard should be had to the natural veins and fissures of the rock as means of facilitating its detachment from its bed.

ON FUEL.

Article V.—Varieties of Coal.

The most important varieties of coal are Lignite, Bituminous coal, and Anthracite; these, although very different from each other in the well-marked specimens, pass by insensible gradations into each other, so that there is no precise line of difference to be drawn between them.

Lignite, also known as brown coal, wood coal, and bituminous wood, is found chiefly in the later geological formations, those which are met more recent than the true coal measures. It is remarkably characterized by the large amount of water it contains; from fifteen to twenty per cent., or even more, remaining after drying by long exposure to the air at ordinary temperatures. This amount of contained water greatly lessens its calorific power, and renders it far inferior to true coal for all useful purposes. Lignites, generally speaking, do not yield a coherent cake, even if exposed to a red heat in a close vessel. In appearance, they are often wood-like and distinctly fibrous.

One of the most celebrated deposits in England is at Bovey Tracey, in Devonshire, where the beds varying from four to sixteen feet in thickness, alternating with clay, were formerly worked to a depth of eighty feet. In 1812 a pottery was established in the neighbourhood, which was worked by the fuel obtained from these beds. As ordinary household fuel the lignite is only employed by the poorer classes, as the smell given out during its combustion is of a very offensive character; at present the supply seems falling off considerably. This Bovey coal is black, but brown when powdered; its fracture is uneven, and it has no apparent fibrous texture. Its specific gravity is 1·129; and it consists, exclusive of the water it contains, of carbon, 66·31; hydrogen, 5·63; oxygen, 22·86; nitrogen, 0·57; sulphur, 2·36, and ashes about 2 per cent.

The presence of Lignite in the later geological formations is one to be carefully borne in mind. Large sums of money have been at different times wasted by persons ignorant of this fact, seeking for coal in the cretaceous and other recent groups, in consequence of the discovery of a small deposit of lignite in those localities.

On the Continent, where coal is much less abundant than in England, lignite rises to considerable practical importance. Thus in the entire Empire of Austria the amount of lignite obtained annually is stated by the latest returns to be 907,037 English tons, as compared with 1,162,950 tons of coal.

The amount of lignite raised in France in five years was 1,678,126 tons, as compared with nearly 25,000,000 tons of the other varieties of coal.

Bituminous coal may be defined as that which burns with a smoking flame, and occupies a position between lignites on the one extreme and anthracite on the other. Bituminous coal cannot be very closely defined, as the different samples vary to a very considerable extent, in colour, hardness, fracture, and other properties; but they all burn with a smoke-yielding flame, and when heated in close vessels, yield certain volatile products, consisting chiefly of water, tarry liquids, ammonia, combined with sulphuretted hydrogen, and there remains behind a carbonaceous residue, known as coke, which includes the mineral matters of coal.

Bituminous coals may be divided into those which swell and become soft and pasty when heated, from being more or less fused; they consequently adhere together, and are therefore termed caking coals. This softening does not take place until the decomposition of the coal has commenced, and consequently it is always accompanied with the emission of bubbles of gas, which burn with a bright flame, if the operation is conducted in the open air.

This pasty condition remains for a short time after the heated coal has been removed from the fire. The peculiar circumstances on which the property of caking depends, are not clearly understood, as caking and non-caking coals may have the same ultimate composition; the phenomenon may, however, be somewhat illustrated by the formation of the moulded carbon filters, and the dense coke which is formed for electrical purposes. If powdered coke, charcoal, or anthracite be heated in a close vessel caking does not occur, but if it be previously mixed with a little tar or pitch rammed closely and heated, a solid coherent mass is obtained, the density of which varies with the amount of pressure to which the materials have been subjected, and in some cases, as in the coke plates used for the carbon batteries, the hardness is so great that they are perfectly sonorous when struck, ringing like a piece of dense earthenware. Another peculiarity of some varieties of caking coal, the cause of which has not been perfectly ascertained, is, that they lose the property of caking after a few days, exposure to the air, and it appears probable that the caking property of many varieties of coal is impaired by a lengthened exposure.

On the other hand, some kinds of non-caking coal may be caked by heating them rapidly in close vessels, the temperature being raised to bright redness. This latter fact is one of extreme importance, as there is at the present time an immense quantity of the slack of such coals wasted that might be utilized if some such process were adopted. In fact, the general waste of coal in this country is a matter of national importance. Of the South Staffordshire bed of coal, Dr. Terry states:—"It is no "libel to assert that this magnificent bed of "coal has been most barbarously treated. "The pits have generally been worked by contractors called 'butties,' under the superintendance of viewers, called ground-bailiffs. "In consequence of the rascality and rapacity "of many of the former, and the ignorance "inattention, and fraudulent connivance of "the latter, an enormous amount of coal has "been annually lost to the nation. Even at "the present day the South Staffordshire "colliery viewers are frequently very imperfectly educated for their responsible "duties, and the system of colliery mismanagement which still extensively prevails in this "part of the country is a disgrace to the age."

The amount to which coal cakes is a very important consideration, with regard to its application as a fuel. If it cakes too strongly it may become so compact in the furnace as to prevent the passage of air, and consequently perfect and rapid combustion, requiring a great amount of stoking, which in many cases would be quite impracticable with its economical or advantageous employment, in such cases the admixture of the too adherent coal with one that does not cake may be employed with great advantage. In the works at Swansea, for example, an admixture of binding and free burning coal is employed. Without such mixture many kinds of coal are useless for furnace purposes, as they adhere so strongly to the bars of the furnace that they cannot be employed even for steam-boilers.

The coal known as Cannel coal is a free burning, or non-caking coal, which emits a large quantity of gas of very superior quality when heated in close vessels; it does not soil the fingers when handled, and is sometimes, therefore, used for ornamental purposes, its high price, however, and comparative scarcity, render it too expensive for most purposes.

Anthracite may be regarded as a mineral carbon, as it contains nearly 90 per cent. of that substance, it is more compact than ordinary coal, is brittle, and breaks with a conchoidal or shelly fracture, very distinct from the uneven fracture of ordinary bituminous coal, it does not soil the fingers when touched, burns without smoke, and does not sinter. From the comparative absence of inflammable gaseous matter, it is far less combustible than ordinary coal; and requires the draught of a furnace or kiln for its ready combustion.

"The effect of anthracite as a fuel," says Dr. Percy, in his valuable treatise on this subject in his "Metallurgy," "is the rapid production "of an intense heat confined to a space not "extending more than a few inches above the "bars; it is obvious, on this account, that anthracite is not adapted as a fuel for steam "boilers, but by the following simple contrivance it may be advantageously employed in "these furnaces, the ash-pit is kept filled with "water, and deep fish-bellied bars are used, of "which the lowest parts, nearly, if they do not "actually touch the water. Steam is naturally "evolved from the surface of the water, and "enters the fire-place along with the atmospheric air, which sustains combustion.

"On passing through the incandescent anthracite it is decomposed, with the formation "of the combustible gases, carbonic oxide, and "hydrogen, which are afterwards burnt under "the boiler, at a distance from the fire, by the "admission of a suitable supply of air. This "decomposition of the steam causes a considerable diminution of temperature within "the fire-place; but there is no permanent loss "of heat, as, on the subsequent burning of the "combustible gases derived from the steam, "the heat absorbed in the first instance is "again given out and economized. There is, "so to speak, only a transference of heat from "the fireplace to a distance. The bars do not "become sufficiently heated to burn rapidly "away.

"The fire-place should be enclosed above by "a fire-brick arch, as no part of the boiler "should be unprotected above the solid fuel. "The arrangement which I have described I "saw in practice some years ago, at Messrs. "Watney and Son's distillery, at Wandsworth, "and it appeared to be quite successful."

CHARCOAL AS A VENTILATOR.

In another part of our impression to-day we give an abstract of a report on the application of charcoal to the ventilation of sewers. The report has just been presented to the Commissioners of Sewers of the City of London by Dr. Letheby, Medical Officer of Health, and W. Heywood, Engineer and Surveyor. We regard the report as a very important one, as it assists to solve a question of considerable interest. From the experiments which have been mad —and no one can say they were made under favourable circumstances—it is quite evident that charcoal may be made an important agent in promoting and preserving the health of the people in large towns. It appears that dry charcoal is a powerful means of destroying the mephitic gases and vapours of sewers and drains. In the application of charcoal to these purposes, it should be used so as to offer the least resistance to the free passage of the air, and it is desirable that the filters should be protected from wet and dirt. The report is a valuable document, and will, no doubt, have its legitimate influence not only on the authorities in the metropolis, but on those of all large towns in the country.

THE IRON WALLS OF OLD ENGLAND.

LETTER I.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The construction of iron armour-plated ships of war is a question of paramount national importance. It is the question of maritime supremacy which is the life of England. The nation which shall possess the largest, most powerful, and best appointed fleet of invulnerable iron ships will command the seas and harbours of the world, for it will be irresistible for attack or defence.

The attention of the Government and of the nation is no doubt fully awakened to the magnitude of this question. Your valuable and widely-circulated Journal has brought into notice numerous plans proposed, and given the best account of experiments tried; but the subject embraces so many points of scientific and mechanical arrangements, on which great diversity of opinion exists, that a full inquiry into all of them and the publication of known data, founded on the results of practical experience from actual trials, cannot fail to be useful to the public service, and interesting to every Englishman who has his country's welfare at heart.

On the eve of the debates in Parliament on armour-plated ships, for which large sums figure in the estimates, as they cannot fail to command attention, it will not be inopportune to publish in the MECHANICS' MAGAZINE some information on the plans adopted and proposed for manufacturing, fitting, and fastening armour plates.

Coming from an unprofessional source, this information will carry with it no weight of scientific authority, but it is founded on observation of practical results, and may contribute something to the general stock of knowledge on a subject but little understood. A free discussion of the plans referred to, and of the principles on which they are founded, will enable your numerous readers to form an opinion of their several merits and defects, and will aid the authorities in applying usefully and fairly the sum of £40,000, included in the estimates, for experiments on the means of protecting and destroying armour-plated ships.

Amongst the points to be considered, perhaps the most important is the mode of fastening. When the size and weight of armour-plates is taken into account, it will be understood that the best method of fastening is an interesting problem. It has for some time occupied the serious attention of Government, and is a special object of investigation with the Iron-Plate Committee.

The dimensions of the plates which compose the armour of the Warrior and other ships already built, and of those intended to be applied to several ships under construction, are 12 to 15 feet in length, 3 feet to 3 feet 6 inches in width, and 4½ to 5 inches in thickness. To attach these large and ponderous masses of iron, weighing 3 to 4 tons each, securely to the frame of a ship, is a matter of much practical difficulty, which hitherto has baffled the mechanical skill and ingenuity of the most eminent engineers and shipbuilders.

The only method of fastening which has been applied to the ships already built is, the rough and ready one of through bolts with conical heads passing through holes perforated in the plates, and fastened with nuts inside the ship's skin. Other plans have been proposed, and are under consideration.

Before entering further into the subject, it will be well, by way of illustration, to call attention to the annexed diagrams, showing some of the modes of fastening referred to. With your permission, drawings of other plans will be given in your next publication.

A right understanding of the nature and effect of the fastening proposed in any system of iron armour will go a great way to determine which system will afford the best protection to a ship of war. The quality and texture of iron, the form and size of plates, and the arrangement of backing and back supports for resisting or neutralising the effect of projectiles, are points of much importance; but obviously none of those points will be of any avail to render a ship invulnerable, if, owing to some defect in the fastenings, the armour-plates are liable to be fractured, damaged, or distorted by the impact and concussion of projectiles, and to be knocked clean off the ship which they are intended to protect.

Taking this view, we are led to the conclusion that any plan of protective iron mail for a ship must be subordinated to a really effective and practicable mode of attaching and holding the plates securely to her sides, and especially of protecting the fastenings themselves from injury.

With this observation, and referring to the diagrams, we will give some explanations relative to

THE FASTENINGS OF ARMOUR-PLATES.

A little consideration will suffice to determine that to fasten an iron plate to a surface of wood or iron the plate must be laid hold of in such a way as to be held securely, and drawn or pressed firmly to its bearing. The obvious methods are, 1st, A bolt or screw passing through the body or edge of the plate from the outside, and holding it by a head of greater diameter than the stem. 2nd. A bevelled or dove-tailed framing at the joints of the plates overlapping their outer edges. 3rd. A perforation of some kind, into the body of the plate from behind without passing through to the outer surface. 4th. A flange or rib at the back or sides of the plate to which the fastening can be attached. The two first methods are objectionable, because the holding points, being at the surface, are exposed to the impact of projectiles. The two last admit of a variety of combinations, in some of which, by uniting them together, the best method will probably be found.

FIG. 1.

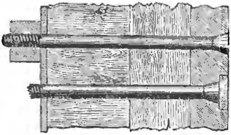


FIG. 2.

Fig. 1 represents the mode of fastening the armour plates of the French frigate La Gloire. She is a wooden ship, the plates are laid over her oak planking, to which they are closely fitted and fastened by screws, said to be 1¾ inch in diameter, and 18 to 20 inches long, with a 3-inch head. Passing through the plate from the outside, these screws are driven through the planks, and into, but not through, the timbers in the usual manner known to shipwrights, and being supplied with two eyes at the head, the screws are closed up tight with the driving tool. The plate is held firmly in its place, but it is said that for greater security, in addition to the screws, a few bolts are passed through and through the planks and timbers, and heaved up with nuts inside the ship. The only experience we have had of this kind of wood-screw fastening is the last trial of Jones' angulated target at Portsmouth, when the concussion of heavy projectiles broke the screws at the first thread next to the plate, which became detached, and fell off into the sea.

Fig. 2 represents the mode of fastening the armour-plates of the Warrior, which is an iron ship. The plate is 4½ inches thick. A 1½-inch bolt, 26 inches in length, with a conical head 2¼ inches at the top, is passed through a hole perforated in the plate through 18 inches of teak backing, and through the half-inch iron skin, to the inside of which the point of the bolt is screwed up by a nut. From an examination of the diagram, the inherent weakness of this fastening will be perceived. The bolt forms a lever, of which the iron skin is the fulcrum only half-an-inch in width, and the two arms are one 22½ inches, the other 3 inches long. The enormous weight outside the skin is suspended to the long arm, and supported by the nut screwed on to the short arm. By this arrangement there is an immense amount of leverage outside the frame and skin of the ship tending to tear away the armour-plate. The bottom strake of armour-plates and teak rests upon the recess, the other strakes rest one upon another, but as the ship rolls and pitches, the ponderous plates at the end of the long bolts have a tendency to fall overboard, and put a violent strain on the nuts and skin. By the constant working of the ship, the bolt-holes through the teak will become enlarged, and the bolts themselves will be loosened, causing motion and vibration with every movement of the ship throughout the whole body of iron and wood (weighing about 1,500 tons), which constitutes the external armour of the Warrior.

With reference to the effect of projectiles on this kind of fastening, we have the results of experiments to guide us. The head of a bolt being struck, acts as a wedge and splits the iron. The plate itself being weakened by the perforations through and through, the vibration caused by the shock of cannon balls produces cracks at the bolt-holes. The target trials have exhibited numerous instances of these effects. At the experiments on the section of the Warrior at Shoeburyness a 100-pounder Armstrong shot which struck the head of a bolt drove the bolt right through the armour-plate, the teak backing and skin plate, into the inside of the section, and extensively fractured the plate, crushing it over a surface of 10 or 12 inches square into the wood, and causing several deep cracks in the iron. On another plate the effect of a salvo was to produce a fissure 18 inches long from a bolt-head to the outside of the plate, and several other cracks, which originated at the bolt-holes without the bolt being struck. A small trial target, consisting of an armour-plate, backed with solid cast iron, affords another example. A 100-lb. shot produced no effect on the face of the plate beyond a slight indentation of the iron without any crack or distortion, but the outside of the shot having struck a bolt-head, a large piece of the plate was broken off at the bolt-hole, and the block of iron behind that part of the plate was shattered into fragments, whilst at other points struck it suffered not the slightest injury. In numerous trials on iron plates, fastened with through bolts, they were broken up into triangular pieces, of which the angles were the bolt-holes.

FIG. 3.

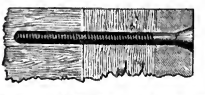


Fig. 3 exhibits a proposed mode of protecting a through bolt from the impact of shot by countersinking the head and covering it with an iron plug. The plan, I believe, has not been tried, but the probable result of its application is that the impact of projectiles on the plate will produce such an amount of vibration in the iron as to cause the plugs to fly out like a bung from a cask when struck by the cooper's mallet, and if the plugs were struck, there is reason to apprehend the damage to the plate would be as great as if the head itself received the blow.

FIG. 4.

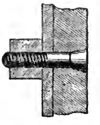


FIG 5.

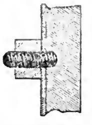


Fig. 4 represents the same mode of fastening as that of the Warrior, but without teak backing. A large target on this plan of the same size as the section of the Warrior (20 feet by 10 feet) is about to be tested at Shoeburyness. In lieu of the wood backing a weight of iron equal to that of the 18 inches of teak is added to other parts, the armour-plate being 5 inches, the skin plate 1 inch in thickness, and the ribs or iron timbers 18 inches instead of 24 inches apart, so that the iron structure is greatly strengthened. The armour-plate is in immediate contact with the skin. The point to be determined is whether iron backing or wood backing affords the best protection to armour-plates and their fastenings. As regards the latter, it is to be feared the effect of the absence of wood backing will be a great amount of vibration transmitted by contact from the armour to the skin plates, which, acting directly on the bolts may cause them to break off at the thread of the screw inside the skin. It is also to be apprehended that the vibration may damage the ship's rivets. But the trial of the target will set these questions at rest in a few days.

Fig. 5 represents a system of fastening by means of a screw-bolt, tapped at one end into the back of the armour plate, and fastened at the other end, inside the skin, with a nut. The arrangement is simple, and before the tremendous effect of projectiles at a high velocity on iron plates was ascertained by experiment, the opinion of many eminent engineers was in favour of the plan. But this was an error which the practice of heavy guns dissipated. A target with this fastening was constructed and tried at Shoeburyness. The concussion of shot on the plates broke off the screw bolts at the first thread, at the back of the plate, a result which might have been anticipated, if it had been remembered that the bolts being tapped into the plates became the points of resistance, and received the full effect of every shock.

With reference to these fastenings, the present state of the case requires notice. The defective and damaging character of through bolts is proved and admitted. Still, it is the only fastening approved, or adopted, by the Admiralty. More than two years ago, it was ascertained by experiment that plates, fastened with through bolts, buckled at their extremities, and as a remedy the notable expedient of tongueing and grooving the edges of the plates was had recourse to. No experiment, however, was tried; the plan was assumed to be perfection, and forthwith adopted for the Warrior and three other ships, at an additional cost of some £10,000 for each. Recent trials have demonstrated that the remedy is worse than the disease. It is useless to conceal the fact, that not only does tongueing and grooving not prevent buckling, but it causes the ripping up of the iron, and aids the destruction of the plate. During last year, in naval reports and in Parliament, this system was announced as a great improvement, and claimed as one of the advantages possessed by the Warrior over her rival La Gloire. It is now abandoned, the error is discovered, but why not discovered sooner? Why did not the Admiralty spend a few hundred pounds in experiment, before it committed itself to the expenditure of *tens* of thousands.

But in the use of through bolts and outside fastenings, the same want of forethought still prevails. Armour plates for six or eight ships, to the value of half a million, are manufactured or ordered. These plates are of the form and dimensions adopted for through bolt fastenings, a great number are perforated with bolt holes, and expensive machinery is set up to continue that operation, and bend the plates by hydraulic power. All this is done, and the work is pressed on, as if no other fastening but through bolts were possible. Tardily some important experiments are to be made with trial targets on a large scale; but it is remarkable that in every case the fastenings are external, and consequently exposed to the impact of shot. But out of a number of systems of fastenings placed out of the reach of shot, which have been proposed to the Admiralty, and some of them approved by the Iron Plate Committee, not one, except that of tapping screws into the back of the plate, which proved a failure, has been admitted for trial at the Government expense.

The trial of some of these plans would cost a few hundred pounds. The success of any one of them, by changing the mode of fastening, might modify the form and dimensions of the plates, and so materially diminish their size and weight, as greatly to reduce the price of the iron. But these considerations are disregarded. As £30,000 or £40,000 have been wasted in tongueing and grooving, without previous trial, to save the expense of experiments, so may £500,000 be thrown away from the same mistaken economy. For if an improved method of fastening should supersede that of through bolts, all the ships under construction will have to be re-plated.

It may yet be time to open the eyes of the authorities. The observations I have ventured to offer, may not be without effect; and you, Sir, with the view of improving the national defences, and putting a check on wasteful expenditure, cannot do a greater service than to fix public attention on this question of the fastenings of armour plates. A CIVILIAN.

There is some talk of a National Italian Exhibition to be holden at Naples during 1863.

THE ARMSTRONG GUN.

PART II.[*]

TESTING THE RELIABILITY OF SIR WILLIAM ARMSTRONG'S REPLY.

I NOW in turn proceed to test the character in its more general features of Sir William Armstrong's reply.

I ask as follows: Should not the publication of statistical tables from departments of state have been preceded by their submission to Parliament? Is there a subject on which Parliament would be less likely to forego its right to prior examination than on the progress of the new gun adopted by its sanction at so great expense for arming both the national services? Have the contents of the two tables published in the letter to the *Times* of the 27th of November on "The Armstrong Gun" ever been submitted to either Parliament or the public before? Are those who are in charge of official records entitled to publish them whenever and through whomsoever they may be persuaded so to do?

Thus I submit for consideration whether it be right or seemly that the publication of these official tables should be made for the first time for purposes of personal controversy in the public press.

Again. When statistics cited in support of the one view of a disputed subject are found to have been compiled during the dispute by those only who are interested in supporting that view, are not such statistics held to be *ex parte* evidence only, and of no weight as impartial testimony? Are not such statistics held to establish a common interest between the compilers, and those who have furnished the means of compilation, equally disentitling the testimony of all to any claim for impartiality? Is a common object the less established because the party most personally concerned is himself the compiler of the statistics, obtaining for his purpose all requisite particulars from "official resources" placed at his command? Is this common object the less clear because this compiler is the *quasi* contractor for an important article furnished to the departments whose "official resources" are thus put before him in order to defend the character of that article; its efficiency having been publicly challenged?

Thus I impugn at its very source all reliability on these statistical tables as being in any degree more impartial in their evidence than would be that of any other witness in his own favour.

I now appeal for proof to the writer's own dates.

He tells us that in Table 1, the column "Number [of guns] returned for repair," is taken from a full official report dated the "20th instant [November], and *now before me*," *i.e.*, a week before the writer's letter appeared and a month after my own of October.

Of Table 2, he tells us, "I have taken their number [so-called "vent-pieces blown away"] from the official report *ordered* by the Director of Ordnance and dated the 14th instant" [November], *i.e.*, thirteen days before the writer's letter appeared, and twenty after mine.

Then after many long paragraphs detailing all the vent-pieces, *i.e.*, breeches, "put *hors de combat*" during the several rounds fired, by the various guns described, at the different stations named,—not in any instance, be it observed, during a representation of real action, but all of them rendered "unserviceable" (except the two in China) either at instruction practice, or experimental practice, or practice apparently for the public press,—after all this we are told, "The above (untabulated) statistics are taken from *Official Reports before me* from the Horse Guards and Admiralty, dated respectively the 7th and 14th instant" [November], *i.e.*, thirteen days again before the writer's letter appeared, and twenty again after mine, in the one case, and in the other case thirteen after mine and twenty before his.

These dates then of "Official Reports" placed before the Compiler for his Statistics prove them to have been "ordered," or collected between the time when my letter appeared and that reply to it by him, of which they are supposed to constitute the chief force. But, instead of these statistical tables being copied from originals kept in the several offices in systematic readiness for reference, it is evident their contents have been hastily gathered together for the special purpose of giving *eclát* to this common letter of defence, and are shown as follows, by Sir William himself, to have been publicly introduced to one another in "statistical form" for the first time on the morning of their appearance in the columns of the *Times*. Thus, "My shortest course will be to exhibit, in a tabular form, the number of my guns which have been proved and issued for use, the number which have been returned from service for repair, and a *few other particulars*, all of which I have obtained from official sources." Thus the compiler himself shows by their dates of collection the *ex parte* character of even the official records from which he framed his tables. Their further untrustworthiness I will show presently.

---

[*] We have offered some observations on this admirabl letter in another part of this Number of the MECHANICS' MAGAZINE. Want of space prevents us inserting the first part of the letter.

The special purport of the reply itself is disclosed to us in the prologue to table 1, as follows:—

"The public have a right to be anxious on a matter so intimately concerning public expenditure and the national defence. . . . . A brief statement and a few statistics (which I hope will be to the purpose) will lead them [*i.e.* the public] to view with tranquility the strange storm of criticisms to which the gun finds itself so frequently subjected."

Now, presuming from the above dates that the "storm of criticism" thus to be laid was the one which proceeded in October last from that unpronounceable place in Perthshire, I candidly confess, as the author of it, that my express object was to disturb as deeply as in my power, the existing false tranquility on those same two grave matters specified by the writer: and, as I adhere to that object still, I meet this avowed purport of his reply by asking, should not those who propose to tranquillize the minds of others on any matter, exhibit on that matter tranquility of mind themselves? Yet here we see a *quasi* official association putting into hasty operation the subordinate machinery of many departments in order to contribute a reply to a plain letter, stating certain plain facts, which I trust to show that it was no more than an obvious duty publicly to submit.

Again, the writer soothingly tells us, "The public are not in the same position as I am; they have not the means of knowing those broad [of course tranquillising] facts which are known to the Government and myself." And then proceeding in due time he shows that, of the statement contained in that October letter, one was "utterly wrong," another "hollow and absurd," another inconsistent with "simple truth," &c., &c. How then, I ask again, does all this superior knowledge exhibit its tranquillizing effects on the minds of its possessors, when they resort to the extreme measure of making Government offices furnish the defence of a public contractor, whose accepted manufacture had been stated to require investigation as to its fitness for public use? Who believes that this hubbub throughout the several regions of officialdom arose from the innocent exposure of some fresh instance of error by a mere outsider? Who fails to perceive that nothing but an unwonted flash of "simple truth," finding unwelcome entrance from that unofficial outside, could excite in eyes habituated to inner brightness only, such sudden sensations of alarm. But if one more than another within those regions were thus alarmed it was evidently the writer—the chief tranquillizer—himself, who knows perhaps more clearly than all around him (since the competitive trials of Shoeburyness have failed to produce any satisfactory plan for rifling our stock of smooth-bored ordnance) that under his auspices England has practically at this moment *no System of Rifled Ordnance whatever;* nothing, as I shall presently show, which can pretend to represent the term, unless it be that doubtful field-piece officially proved to be of inferior range and accuracy before the first rival it was permitted to compete with.

I trust I have now entirely undermined all confidence in these statistical tables, as well as all that (false) "tranquillity" they were intended to produce. But, before exhibiting their untrustworthy character in fact as well as principle, I first proceed to show that I clearly distinguish who are, from who are not, the opponents engaged against me. I ridicule and reject the assumed association of Sir William Armstrong's, the "Government and myself." There are two great officers of state in the Government, truly so called—its deservedly popular chief, and the chief over all things military, both of them have recently given proof of their desire to discern the truth for themselves in this important matter over which they exercise a primary authority. But more or less connected with several departments there are undoubtedly those with whom a *quasi* association with the writer exists; many who are more or less linked to him by friendship, by common labours, and common hopes of success, and for whom, therefore, he pleads quite as earnestly as for himself where he says,—while absorbed with his friends in seeking for some durable breech for his 40-pounder gun—"I think the public may safely leave the matter with the authorities and myself."

In these "authorities and myself," then I thus fully recognise myself to be face to face with a *quasi* official co-partnery, the ablest member of which has been ployed to put forth this combined letter of defence and attack, the very dates in which proclaim the copartnery to be that of Woolwich, Whitehall, Pall Mall, Elswick, and Co. To which, if disposed, I might with equal justice add the word "excellent,"—a potent league, no doubt, to associate in a deliberate assault on one man. But why commence that assault with a hollow compliment as to manliness, which it ought to have been felt could neither be accepted nor returned?

As to the particular person in which to regard the writer himself throughout his letter; the monopolist, secure in his prize and in his bond upon those who awarded it, no doubt appears in the liberal sentiment, that "in the long run the best weapon must win the day, whether it be mine or another's;" but vain is the search for the Government inspector, watchful against every taint to the national weapon he supervises; and where is that paragraph in which the inventor, manufacturer, or contractor, is not more or less openly seen? Table 1, compiled by himself, gives the "contract price" of all his articles; and thus we recognize that person, in which he specially delights to present himself;—boldly, no doubt, but not more so than is fully justified by the consciousness of an amount of official support, as we have just seen, quite unheard-of in England for many years.

I proceed, then, to test the chief features of Sir William's reply, limiting myself to the cases of the 100-pounder, 40-pounder, and 25-pounder, naval guns; and taking the professed principle with which he ushers in his table 1, for myself to observe also, in my comments upon it, viz., "I will therefore let your readers know *all that I can tell them* on points lately raised, and they shall judge for themselves."

1st. Table 1 entirely omits "failures on proof," making the "number in store" and "number issued for use," to equal the "number proved," and so leaving it to be inferred that no failures on proof take place. This inference, it will be said, is disproved by the footnote; but the "guarantee" there stated, besides being of recent date, is quite inoperative in respect of supply. As "failures on proof" are numerous, so will supply be untrustworthy, and become most so when the emergency is greatest. The price must also be raised the greater the loss by "wasters." There is every reason to believe that these failures are and have been numerous. On high authority, totally unasked, I was recently informed, as instances, that an Elswick 100-pounder had just failed on the second charge at proof, shooting out its inner tube to the rear about three feet; my informant adding, that shortly before he had seen a 40-pounder also, with the muzzle blown off on proof.

2nd. The table omits all notice of guns "re-made." This process, as has been openly published in the Army and Navy Gazette, becomes requisite from the intense friction of forcing the shot through a grooved barrel of less diameter than itself, which thus in its passage separates, more or less, the several coils of which the inner tube of the gun is composed. So general is this separation in the Armstrong guns manufacured on the "coil system," that up to a certain point it has come to be disregarded, as of no import; but, when it prolongs the powder chamber too much for the ordinary cartridge to fit, a special cartridge has been devised, in shape like a dumb-bell. The two full-sized ends being placed, against the shot in one direction, and the breech in the other, the narrow waste lies between the two, and the "air space" is thus limited to the centre of the powder chamber where it will do least mischief. When this stretching however, exceeds the power of a dumb-bell cartridge to remedy, the gun must be "re-made." The over-stretched inner tube is carefully removed by boring to within one-tenth of an inch from its outer surface and the "skin" to which it is thus reduced is as carefully separated from within the outer strengthening layers of coil, which are again replaced over a new inner tube. The cost of the operation—which, of course, there are no means of performing on board ship—is stated to be about £80; and upon the heap of these "borings," collected at a spot in Woolwich Hospital, there may be counted the "skins" of inner tubes from many (near twenty has been named to me by one party) of the larger Armstrongs, apparently belonging in equal proportions to those manufactured out of "solid forgings" and of "coiled iron;" besides other "skins" contained in the body of the heap, estimated to amount to many more. Whether these are the wrecks of victims to "proof," or to "experiment," will only be determined by authoritative inquiry; but whatever their cause of defect, or exact number, all must have failed *prior* to any test by real Service.

It further appears that full-lengthened inner tubes for a 100-pounder and a 40-pounder gun are now being made at Woolwich, not, as before, from "solid forgings" of iron, but from castings of gun-metal, 1¼ inch thick; which, if found capable of withstanding the stretching effect of rifling the shot, are destined, it is said, to replace the present inner tubes of all 100-pounders and 40-pounders made on that "coil system," whose superiority over the "solid system" is, by the Manufacturer, asserted to have been proved, by the successive "disabling" of the three 100-pounders in the "Stork.". No one, of course, can fail to wish success to this new experiment for preventing altogether that unheard-of "over-stretching" in the very core of a national weapon, for which neither dumb-bell cartridges, nor "re-making," are evidently considered satisfactory cures. But what then becomes of that happiness of the Manufacturer in which we are invited to put our trust, because, for "some time past he had overcome all manufacturing difficulties." By his former denunciation of the more than two hundred 100-pounders made on the "inferior plan," and by his present endeavour to change the very metal of those made on the "superior plan," does he not in the most effectual manner proclaim his own distrust in the very principle of manufacture adopted for all his larger guns alike?

3rd. The Table omits all notice of the 40-pounders, from fifty to seventy in number, notoriously recalled for the purpose of being strengthened, their structure being too weak at the rear of the barrel to be safely used without such alteration.

4th. The Table omits all notice of the 40-pounders and 100-pounders, in number not at present known, recently re-made, or preparing to be re-made, upon "inner tubes," having their exteriors "tapered," so as to resist the stretching and back-shooting action of the shot; this tapering of the external surface of inner tubes being another experimental means of prevention, not, I believe as yet proved, by which, if successful, the character of the "coil system" may still be saved.

5th. The Table omits all notice of the "long" 25-pounder, a gun specially designed for minor Naval services in boats, &c. Its range is understood to have been very deficient, and its recoil very great, for which, and, perhaps, other sufficient reasons, it has been altogether withdrawn; where, and for what other Service, if any, and in what numbers, a close inquiry can alone determine. We have its substitute, however, in a "short" 25-pounder, having shot of two distinct weights, and two distinct charges to suit; only the larger shot of 25 lbs uses the smaller charge of 2lbs. 8ozs., and the smaller shot of 21lbs. uses the larger charge of 2lbs. 10ozs.

Moreover, the official range table tells us that 2,580 yards, and 2,680 yards, are the powers of this gun at 10° of elevation with the big shot and little charge and the little shot and big charge respectively. It also tells us that these same ranges will answer "for the 25-pounder common or segmental shell," apparently with big or little charge alike. From all of which upside-down complication, it may be concluded that, although the "long" 25-pounder has been altogether withdrawn, the "short" substitute is commissioned to consume its projectiles; but whether most to the advantage of the Contractors or to the safety of the Armstrong boat-service of Her Majesty's ships, I leave those most concerned for the two opposite interests to settle between them.

Such are the greater omissions in the department of "National defence," all most properly made by Sir William when compiling his table No. 1, for the avowed purpose of leaning to the public "tranquility" about his gun. I now point to the omissions made by him with equal propriety for the same laudable purpose in the department of "public expenditure."

1. The table omits the price of manufacture per gun at Woolwich Arsenal, an omission the more important, as by the strict monopoly given to the contractor this is the sole factor permitted to compete with that at Elswick.

2. It omits all notice of cost for experiments, which, under the head of "experimental practice," have been, are, and apparently will long continue, very considerable. In the case alone of the cast-iron 68-pounders intended for rifling on the writer's "shunt" principle, this cost must have been very serious. From 200 to 300 guns newly cast for the purpose were delivered, or delivering, out of a contract, as is said, for about as many thousands, but one after another their failure "on proof" was so continuous that the experiment as well as the contract had to be abandoned. Several of the burst guns were seen by me in June, 1860, The writer's contract it will be seen throws all experimental expenses off himself.

3. It omits all notice of cost for shot, shell, and fuzes, whether in the aggregate or detail; an omission only less remarkable than if it had been of the guns themselves, and which could be paralleled only if, in the accounts (say) of the Peninsular and Oriental

Company, all notice were omitted of the cost of "coals." All notice of the public store of shot, &c. is thus omitted also, whereas if these delicate projectiles; the most simple of which are compounded out of three distinct metals; continue to prove as little durable as they now promise to be, their periodical renewal, as well as ordinary expenditure, must be provided for as in the case of powder. The position of the present stock of 100-pounder solid shot may receive some illustration thus. At the Armstrong lecture in May last, it was openly stated that the solid shot for this gun had not then been "determined on," *i.e.* twenty months after firing at the Trusty, with experimetal 100 lb. shot. About two months later no service-shot for this gun had yet been either received or issued from Woolwich arsenal, the first single specimen of it, there seen, having arrived only during the first days of July from Elswick. The "Stork's" 100-pounder was, I believe, the first gun "on Service" to use this shot, and did so for the first time on "Jones's" target, on the 21st of August last. The channel fleet before returning to winter quarters was not, I believe, supplied with a specimen of this shot, *all its Armstrong 100-pounder practice being made with shell and 12 lb. charges*, none with the 110 lbs. solid shot and full 14 lb. charge. But one of the 90-gun ships since sent to America has left, I know, with *as many* as fifty 100-pounder service-shot. The official range tables for the 100-pounder framed in June last, ignore even the existence of this shot, but the same tables give the 40-pounder shot ranges, as also those before noticed for both the 21 lb. and 25 lb. shot from the "short" 25-pounder gun, commonly called the 20-pounder.

Following the writer's example, "my shortest course"—to assist the memory in retaining the above omitted items—"will now be to exhibit them in a tabulated form," under his own two specific heads, in the following.

OMISSION TABLE.

"NATIONAL DEFENCE."					"PUBLIC EXPENDITURE."			
100-pounders on same "inferior plan" as those of "Stork."	Failures on Proof.	Guns remade.	40-pounders recalled to be strengthened.	25-pounders recalled and substituted.	Cost per Gun at Woolwich Arsenal.	Cost of Experiments for each Class, including 100-pounders of 1860.	Cost of Shot, Shell, and Fuses, &c.	Cost of all "Vt.-Pieces," i.e., Breeches, made and paid for.

All numbers are left for the proposed inquiry to fill in. Guns with tapered inner tubes, and inner tubes of gun-metal, are considered to come, as yet, under the head of Experiments.

The writer would naturally be more correct in what his statistics do show than in what they do not, but the following will suffice to illustrate the unreliableness of his table 1, in this respect also. Under the head of "Number returned for Repair," the whole four 100-pounders shown are necessarily those specified in my October letter, including the parent 80-pounder, all avowedly "returned" for more or less of repair; and to this number I can myself state that at least the following ought to have been added:—

First. Not less than five 100-pounders repaired by brass linings about two feet long and one inch thick in the chambers. Second. From ten to twenty 100-pounders retubed in about equal numbers from the "solid forging" and "coil" systems; some few with tubes "tapered." Third. Two 100-pounders returned from Shoebury; one badly "cracked" in the chamber, the other only "flawed." Fourth. One 100-pounder with its grooving cut up by a shell bursting within it. Fifth. One 100-pounder returned from the Channel Fleet cracked as before described, after only 15 rounds, right throught its thickest part at the breech aperture. And Sixth. Of 40-pounders, six or seven, which have been retubed in manner as at first; not to specify many more, I am told nearly 20, now awaiting the doctor, some no doubt to receive "tapered" inner tubes when ready.

The particular column in table 1, which is headed "Number burst," is evidently limited to cases where the sides of the barrel explode, and this of course they do not whenever, as in the Armstrong, there is any other weaker point to burst or give way first. Thus the two 40-pounder muzzles, which, as the writer explains to us, were "blown off," and "fell off," in their respective ways, are excluded from the table. And in like manner it totally ignores that frequent destruction in different ways of the breech itself, which, being the weakest point of structure both in principle and detail, is the part of the gun to which occur all accidents parallel to the bursting of an ordinary barrel, and which, in candour, ought therefore to have been found under this head, and in this table.

For the breech of any gun to be the weakest point of its structure is, however, I believe, unprecedented, and to be paralleled only by some plan of ship whose weakest part should be her bottom. No great pains have been taken therefore to place this reality before the public, who, by a bold misappropriation of terms, have been led to believe, when hearing of the tendency of the Armstrong guns to "blow away" or destroy their "vent-pieces," that it was some minor part of the gun—generally supposed to be a "nipple"—which was so troublesome in its failures; and those more practically acquainted with the gun have alone known that the true difficulty, unsolved to this moment in the case of all the larger Armstrongs, is to find some safe and durable material for the true breech of the gun.

In passing, therefore, from No. 1 to No. 2 Table, which is all about "vent-pieces," it is requisite to explain in some detail what a "vent-piece" truly is. There is a small flat projection seen on the top of every gun around the touch-hole through which the vent passes, which is cupped to receive the priming powder if using a match, and is used for fixing the flint, or percussion lock, or the "crutch" for the friction-tube, when using these more modern means for firing cannon. This is the true "vent-piece," also at times called a "vent-patch" or "vent-field;" and the Armstrong therefore requires and has this convenience as well as every other gun, its "vent-piece," together with the touch-hole and crutch for friction-tube, being fixed—not by necessity but choice—on the top of that projecting neck or handle of its breech by means of which each time the gun is fired and reloaded this breech is lifted in and out. The vent-passage is likewise pierced down through the centre of the same handle. The breech with its handle is thus made to contain the vent with its "vent-piece," and these of course become subject to whatever vicissitudes befall the breech itself. Now Table 2 enumerates and classifies thirty-seven such vicissitudes, and about fifty others (if they be others), are said to exist in different forms of wreck in the office of the Ordnance Select Committee. But in none of these instances will it be found, I believe, on examination, that any injury or "disabling" whatever, has originated with the vent-piece proper, nor that even the vent-passage has been at all seriously worn, but, on the contrary, that it is the *breech itself* which has invariably given way, rendering useless of course the vent and vent-piece constructed in and on it. And, in proof that this position for the vent-piece and vent has been determined entirely by choice, I add, that there is now being constructed at Woolwich an entire new description of breech (so-called vent-piece) for 100-pounder and 40-pounder Armstrongs, which is solid, the vent being removed out of it and pierced through the barrel, to which therefore the true vent-piece, with its conveniences for firing, must likewise be removed, and with it every specious excuse for the name of a minor detail being deliberately misapplied to the most important part of a gun.

It yet remains to explain then what that article truly is of which No. 2 table exclusively treats under this misnomer of "vent-piece;" and the official Instruction Book itself for the Armstrong gun Practice will, I think, do this in the manner least likely to be disputed, as follows:—

"Vent-piece. A plug of steel or wrought-iron, containing the vent. This plug when in the "slot" *forms the bottom of the chamber*, and is firmly fixed in its place by the action of the *breech-screw*."

I need scarcely observe that whatever "forms the bottom of the chamber" in any gun, be it large or small, and whether the vent is contained in it or no, has to sustain the whole of the reactionary shock of the discharge, and has ever been known as its true breech. And accordingly in the Armstrong, whenever this "plug" is removed, the barrel becomes a mere hollow tube, to be seen through from end to end, and so remains until this "plug" is restored; and when without this "plug" the gun is no gun, any more than a ship would be a ship without her bottom. If, therefore, it be borne in mind that whenever this so-called "vent-piece" is "blown away," or otherwise disabled, it is the actual breech of the gun which is blown away, and that the Armstrong is then in the same disabled condition as any ordinary gun would be which has blown its breech out, it will at once be seen how general and serious a misunderstanding has been induced upon the public mind by this no accidental misnomer; as also that the true import of Sir William's table 2 thus consists in its being his own list—very incomplete however—of the practical destruction of breeches in the several classes of his gun.

But these points will be strongly illustrated, by restoring things to their right names, in the following introductory passage of the writer to this same table 2; "I may remark generally that the breech is not expected to have the same durability as the gun; it is separate from the gun, and contains the vent or touch-hole, which is the most perishable part of all ordnance. Every time the weapon is loaded the breech is removed; two of them are attached to each gun, and, if one is injured by casualty or wear of the vent, the other is ready to replace it. *A list of injured breeches is therefore not a list of accidents.* The list below comprises not merely broken breeches—indeed a wrought-iron breech has never been known to break—it is made up of breeches worn in long and honourable service, as well as those broken, bulged, cracked, flawed, or rendered unserviceable in some other way." Upon the force of which passage as thus rightly rendered I ask—Can it be indeed true, that, when first proposed to our military proof-masters, the Armstrong inventor frankly stated that the breech was not expected to have the same durability as the gun;—that two breeches must therefore be attached to each gun in order that if one became injured by casualty or wear, the other might be ready to replace it? Or have these unique peculiarities been elicited since their recommendation of this gun for the national weapon? Again, was it, indeed, perceived that this so-called "vent-piece" was actually the breech; and did the discovery of this misappropriation of terms produced increased confidence in recommending the invention itself? Or was the combined penetration of all the proof-masters concerned unequal to detect beneath a bold misnomer what was, from what was not, the true breech of this gun?

Let these questions be answered when, and how, and by whomsoever they may, but let that answer give public proof, by reference to the standard appellation for the several parts of large ordnance, that "a plug of steel or wrought-iron which forms the bottom of the chamber" *is* the true "vent-piece" of a gun, and *is not* its true breech.

Again, is it indeed true, as the Instruction Book tells us, that the Armstrong breech *is* firmly fixed by the breech-screw? Were it so, the difficulty of getting that breech to stand in the larger guns might be limited to the discovery of some proper material. But firmness is here but another word for solidity, as hollowness usually is for infirmity, and this breech-screw is not solid, but hollow; necessarily so, to admit of the gun being loaded through it; and the hollow is thus necessarily co-extensive with that whole front-surface of the breech which it pretends to support, and upon which the shock of discharge is directly received; while the true support it gives by actual contact is limited to those mere edges of the breech which directly receive none of the shock at all. Why then should such a hollow friend as this afford any firmer support than that which hollow friendship has long been a bye-word for treacherously affording?

Again, this radical infirmity of support by the breech-screw is largely aggravated by that imperfection inherent in all human mechanism caused by "imperfect fit." There is this imperfection at the junction surfaces of breech and barrel, irrespective of abrasions and undetected films of smoke upon each. There is this imperfection at the junction surfaces of breech with breech-screw, irrespective of unequal pressure from undetected irregularities. There is this imperfection at each of the eighteen threads of the breech-screw itself; and there is the more, the more the lubrication; the whole aggregate of these twenty sources of "imperfect fit" taking effect (where that incurable escape of gas comes from) at the joint of the breech with the barrel. Must there not, then, be a "give" and a "take again," (of which that "escape" is the proof) at the instant of discharge, vibrating with violence throughout the whole mass of that breech, whatever its metallic material? And is not that "give" and "take" further increased by the fact that the shot *before* the powder charge is heavier than the breech *behind* it, irrespective of the obstruction presented by the smaller barrel in its front, through which, by that charge, the shot must be forced? So much for the firm support afforded by this hollow breech-screw.

But to turn to No. 2 table itself. I accept its thirty-seven instances of destroyed breeches as a fact in itself perfectly fatal to the gun, incomplete as this list confessedly is. Thus, the compiler himself tells us, in respect to one of the reports furnished for his compilation, "The report itself concludes as follows;—There may be more [that is, vent-pieces blown away], but, as they always arise from carelessness, the facts may not have been noted." He then proceeds to add, on his own account, "Some few other cases, indeed, *as I myself know*, have occurred, chiefly during practice

by Google

by recruits." Is it then a matter of indifference whether an official list of these serious failures in a national weapon be or be not correct? Is it so light a thing, or so common an event, for a gun to "blow away" its breech that it should not even be noted? What will be the reflection of every one who knows what the heat of action must produce, when told that in calm experimental practice the average carelessness of gunners, which is an element always to be provided against, renders so large a proportion of breeches "unserviceable," as this avowedly incomplete list discloses—owing to the self-disabling construction of his gun?

But the table is additionally unreliable as follows:—It gives the number of 1,592 breeches "issued," which with the thirty-seven "unserviceables" makes 1,629 in all; but it offers no pretence that this constitutes the whole number of breeches made and paid for. What then does that whole number amount to, and where is the account of the remainder—as per Omission Table? It will presently be shown that at least there are four more 100-pounder breeches, two of steel and two of iron, disabled in one experiment, and omitted from the list; besides the two notoriously destroyed when attempting to use the incendiary shells.

Again, we are told of a 100-pounder gun expressly employed on the proof of breeches. Are there no failures on this proof. If there be not, why a gun set apart for such duty? If there be, to what extent do they occur, and where do they appear? On a visit to Woolwich not long since, I saw myself two broken 100-pounder breeches which had failed on proof the day before, and was told such events were of frequent occurrence.

Let us see, then, if the writer's "remarks" on this table are more reliable than the table itself. He says, "It will be seen by the table below, that the injuries there entered have chiefly occurred to steel." And again, "The principle of steel having been definitively abandoned, instances of injuries to steel are of minor importance." Take these two remarks in conjunction with the statement, that "indeed a wrought-iron vent-piece (*i.e.*, breech) has never been known to break," and then test their combined value by the figures in the 40-pounder column of the table itself, where, out of sixteen breeches destroyed, it is shewn that seven, or nearly one-half, were of "wrought iron." And in a subsequent "remark," we further find that these same seven breeches were all disabled in one experiment, so recently as the end of September last, during only 142 rounds of firing, which likewise disabled four breeches of steel, eleven in all; the breeches of "wrought iron" disabled under the very same circumstances, and at the same trial, being thus nearly double the number of those of "steel."

Again, the writer tells us of this very experiment, "The pattern of (so-called) vent-piece *will in consequence now be changed.*" And how is that change being made? Steel and wrought iron having both been found separately too weak, their strength is now being ingeniously combined, thus. A mass is made out of alternate layers of both; this mass is then cut into pieces, and the pieces are welded together to the proper size with the course of the alternate layers of steel and wrought iron crossing each other at right angles. As the breech apertures cannot be enlarged without the guns "cracking" at that part more than now they do, these "sandwich metal breeches," as they are termed, are of the same size as their predecessors; but somewhat heavier, as it is these out of which the vent has been removed. No reason is assigned why this "half-and-half" mixture should possess higher qualities of strength than its two compounds, when "entire"; and accordingly it has failed on its first trial under circumstances indicating increased weakness instead of strength. The particular gun chosen to test these sandwich breeches was that which on the above experiment of Captain Coles' cupola destroyed eight of its breeches in the "Trusty," but which became so docile when removed to Woolwich, that it could not in fifty-eight rounds, we are told, be induced to disable one. Either, then, it has now recovered its powers of destruction by breaking the two first sandwich-breeches entrusted to it, *even at Woolwich*, or these have been of weaker construction than those which bore the fifty-eight rounds. What then becomes of the confidence against a recurrence of these casualties which the public is invited to put its trust in, because "the principle of steel has been definitively abandoned?"

(*To be concluded in our next.*)

Protecting Iron from Rust.—Prof. Vogel proposes to dissolve white wax in benzine, and apply the composition to iron and steel tools with a brush. The benzine evaporates, and leaves a thin smooth and permanent coating of wax on the surface, which protects the metal, and resists the action of acid vapours.

SEARS' RICE-CLEANING MACHINE.

Fig. 1.

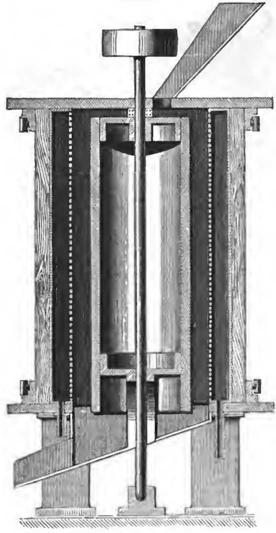
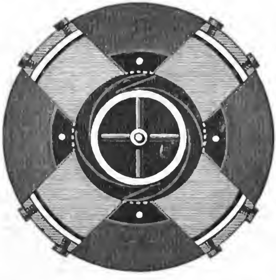
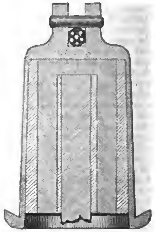


Fig. 2.



This Invention, just patented by H. Sears, of New York, relates to a peculiar construction and arrangement of machinery or apparatus for cleaning rice, and consists in the application and use for that purpose of wire gauze or perforated metal plates and chambers or cases in combination with detachable and adjustable stone blocks the blocks and wire gauze or perforated metal surfaces being so shaped and disposed that when combined they will form a hollow cylinder, in the interior of which revolves any suitable drum or beater as is represented in the above engravings. The wire gauze or perforated plates may either be introduced between the contiguous edges of the stones or inserted into the stones themselves, which in that case are cut away to receive the chamber of which the wire gauze or perforated plates forms the inner surface. The object of these cases or chambers is to allow of the free escape of the meal, which, after passing through the wire gauze or perforated plate or plates. is removed or carried off from the chambers by tubes or spouts to a proper place of deposit. The same object may also be obtained by inserting crosswise at intervals, within the length of one or more of the stones, sections of wire gauze or wire cloth, leaving open spaces behind, so that the meal may be withdrawn at intervals, or as fast as it is formed.

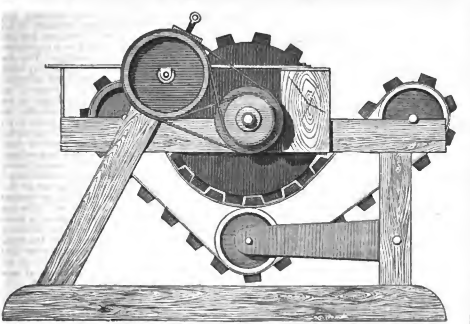
BROOKE'S TELEGRAPH INSULATORS.



This insulator, patented by Sir. W. O. Brooke, of Westminster, consists of an inverted cup or hollow vessel, of a rectangular form, having a recess on it suitable for receiving a wire which may be fixed by solder, clamps of hardened india-rubber, or other material. The edges of the sides at the lower ends being turned up into a trough of a gutter-like form; as clearly indicated in the above engraving. On the interior of the cup is fixed another inverted cup or vessel, composed of the hard compound produced by combining india-rubber and sulphur, and submitting the same to high temperatures. The inner cup or vessel is of like section to the outer cup, but of less dimensions, so as to leave a space in all directions between the inner and outer cups, and such space is filled up with melted sulphur. This apparatus is placed on an upright pin or support, by preference of wrought iron, surrounded with melted sulphur. The pin or support is carried by a bracket or post or other suitable means.

On Wednesday last the New Plymouth lif[illegible] "Prince Consort," which Messrs. Burdell have p[illegible] of [illegible] to the National-Life Boat Association, was la[illegible] the presence of upwards of 50,000 people.

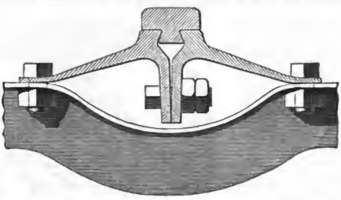
MALLORY & SANFORD'S MACHINE FOR OBTAINING FIBRES FROM PLANTS.



The object of this Invention, by Messrs Mallory & Sanford, of New York, is to obtain from stalks or leaves of fibre-yielding plants the fibres in the white state and of full strength. The fibres are to be separated from the extraneous matter of the stalks or leaves which have been cut from the plants before the sap has ceased to flow through such stalks or leaves, and while they are yet in the green state, by breaking, beating, scraping or combing, or by other like mechanical operation, the extraneous matter being removed from the fibres whilst immersed in or saturated with water or other equivalent fluid, which will prevent the coloring matter of the plant from impregnating the fibres; the fibre-yielding stalks or leaves are cut so soon as it is ascertained that the plant has done growing, but before the sap begins to set, and subjected while in or protected by water to the required mechanical action, such as scraping and combing, to remove the extraneous matter from the fibres. When this has been effected, the fibres are dried, and they will be found to be of full strength and soft and white.

The arrangement of mechanism for effecting the above object is illustrated above. The stalks or leaves are held by means of a griping apparatus firmly to the action of rapid moving combs and scrapers, which break through, loosen, and scrape off the extraneous substances from the fibres. The portion so acted upon is withdrawn by a reverse motion of the feeding mechanism, and the other ends of the stalks or leaves are presented in like manner to the action of the combs and scrapers. The machine is provided with feeding and holding rollers, the upper one of which is covered with vulcanized india-rubber, the lower one being of metal and fluted. On the shaft of the lower roller are two loose pulleys, either of which is capable of being secured by means of a sliding clutch, which enables the motion of the roller to be reversed at pleasure. The rollers are driven by belts from pulleys on the main cylinder. The periphery of the main cylinder is covered with vulcanized india-rubber, and over this are secured three series of bars parallel with each other and with the shaft, and placed at equal distances apart; one series of bars is provided with radial comb teeth, another is formed with the edge waved, and the third formed with a straight edge. An endless band or belt made of strong india-rubber cloth or leather passes under the main cylinder and around two rollers, one in front under the feed table and the other behind the main cylinder, and this band or belt in the lower part of its circuit passes under a tightening roller. The outer surface of the belt is fitted with three series of bars, like the periphery of the main cylinder, and in the same order. The ends of the bars on the cylinder and on the belt are in the form of cogs, and the spaces between them are so proportioned that those on the cylinder fit into the spaces between those on the belt, and *vice versa*, and in this way the belt is moved by the cylinder passing around the lower half of its circumference, and is drawn tight against it in proportion. Immediately above the space between the feed rollers and the main cylinder a spout may be placed leading from a reservoir to discharge a stream of water on to the stalks or leaves to be treated, as they are being acted upon in the machine.

LANE'S IMPROVED PERMANENT WAY.



Mr. M. Lane, of Reading, civil engineer, proposes to use longitudinal bearers of wrought-iron for the permanent way of railways of any desired length. The lengths of which the longitudinal bearers are composed, and the lengths of rails supported and held thereby, may, when desired, be so laid as to break joint. The bearers are each composed of two separate parts, one outside and one inside of the rail, and the two parts are both rolled or formed to a similar section, as is illustrated in the annexed engraving. Each of the two parts of a bearer consists of a plate, by preference of about six inches in width, but this may be varied, and the plates may be of any desired length. These plates rest on the ground at a slight inclination from the side of the rail which they support. That edge of each plate which comes next the rail is turned downwards to the extent, by preference, of about three or four inches. At the sides of the turned-down parts of the two plates, and near the upper surface, where the rail is received between them, grooves are formed, one in each plate, and by preference angular grooves, so that when the two grooves of the two parts of a bearer come opposite each other they will form a dovetail space between the two turned-down parts of the plates of which a bearer is composed. These plates are connected together at intervals by screw bolts and nuts, the bolts passing through the turned-down parts of the plates. The rails used with these bearers are rolled with an under web or projecting rib which is of a dovetail section, or of such other section as will correspond with the space produced by the grooves, in the two parts of which a bearer is composed. The under surfaces of the rail near the outer edges press on and are supported by the plates of the bearer, the under surface of the rib or projection under the rail not coming quite down to the bottom of the dovetail space. It will therefore be understood that a rail will be held securely between the two plates of a bearer which press the rail on each side, and by reason of the dovetail or other section of the under part of the rail corresponding with the undercut or dovetail form of the space between the two plates or parts of which a bearer consists, the rail will be prevented rising; and it will also be understood that pressure on the rail will, by pressing down the bearer, tend to cause the rail to be held more and more tightly between the two parts of the bearer.

NOTES ON THE INTERNATIONAL EXHIBITION.

As nothing has been said at present about the prospects of this important section of the coming exhibition, it is gratifying now to report that there is every promise that the display will be of a very practical and useful character; and whilst our continental friends will, probably, "hold their own," as respects the more ornate fabrics, we shall show that the arts of design have not stood quite still, even in the commoner articles of every-day use, whilst in those tissues in which sound make, excellent dyes, and perfect finish are essential, the advance will be proved to be unmistakable. The class of cottons will receive its strongest contributions from Glasgow, Manchester, as in 1851, having scarcely made an effort worth naming. Singularly enough, whilst this industry represents almost one-third of our exports, the two classes within which it is comprised, classes 18 and 23 (the latter for prints only), will be the two smallest displays of the textile division. Perhaps the present condition of trade may have something to do with this. It is, however, pretty certain that if ever we are to have a really national exposition of this department of industry, we must not rely upon its being got up by the manufacturers themselves.

In woollen and mixed fabrics there will certainly be a more satisfactory series of exhibits. Bradford shows in a collective form. Huddersfield, Halifax, and Leeds take a similar course in the classes to which their products belong. Glasgow follows its movement in cottons, by showing moderately in Class 24, lace and embroidery; and most effectively in marked fabrics, in Class 21. Paisley and Norwich, together with Dublin, will keep up each its old reputation, and the space for seats of industry, the objects shown being varied in colour and texture, has been so arranged in the plan, as to come nearest to the eastern dome; and as the whole of the textile division is in the south galleries, and in fact occupies the whole of the available space in that locality, it is intended that this portion, at all events, shall be made as effective as possible, and yet in keeping with the general result of the arrangements.

The heavy woollens, tweeds, &c., of Scotland, with the blankets of Witney and the flannels of Rochdale, will occupy less prominent but excellent positions in one of the cross galleries, the lace being placed in the other. Here Nottingham takes an important post, and there is every promise that the results will be highly satisfactory, alike as regards design and execution. The products of lace for the metropolitan market will also make an important display here.

The silk manufactures are to be placed against the north wall of the picture gallery, thus getting a purely north light; a great desideratum, as a large amount of valuable material is soon spoiled in positions in which it cannot be defended effectively from the sun. It is expected that the arrangements in this class will be of one uniform character throughout, London, Manchester, and Macclesfield combining for this purpose. With one or two exceptions all the best houses will be well represented. Coventry will contribute its ribbons, but not to any great extent.

The linen manufacture follows silk in this gallery, and the staple of the north of Ireland and some parts of Scotland, will be sufficiently represented. The Belfast Local Committee, too, have organized a trophy for the great nave of the building.

In the gallery which leads from the back of the picture gallery to the eastern dome, the class for clothing is placed, and the arrangements will commence with the feet, in a display of boots and shoes, and pass gradually and systematically up to the head, finishing at the dome with hats. The class has unfortunately needed a great amount of "weeding out," as claims were made for space which could not be complied with, except at the expense of more important industries; for, after all, the heart of the tailor and milliner is so thoroughly the slave of fashion, that unless a great amount of space could be commanded, the more fixed industries had, of necessity, the prior claim.

It is satisfactory to know that the arrangements of the textile department, which have again been undertaken, as in 1851, by Mr. George Wallis, are in a state to give every facility to the exhibitors in fitting-up their space at once. The general plans were completed, and allotments in plan, collective and individual, were all sent out, except in a few unimportant instances, by the day Her Majesty's Commissioners had possession of the building. On the following day, the 13th, the marking off of the spaces on the floors of the south galleries, was commenced, in order that the precise position of each exhibit may be defined; and, as a final matter, the catalogue for the whole division was fully revised in proof by Mr. Wallis, as an official reference, during the arrangements. As a matter of interest, it may be stated that the exhibitors' space for textiles comprises a nett amount of nearly 18,000 square feet of floor, independently of all passages, and the vertical space occupied will probably amount to 100,000 square feet more.—*Society of Arts Journal.*

The Calcutta correspondent of the *Times* says—after inspecting most of the articles contributed by Bengal to the International Exhibition, I feel assured the Indian Department, both in the way of raw products and manufactures, will realize the expectations formed of it in England. The last instalment of the 6,000 specimens leaves Calcutta to day in the Peninsular and Oriental Company's steamer. But you must not expect any valuable or extensive collection of specimens of cotton from this side of India. Although the crop planted last year is pouring into Bombay, in spite of the expectation of war, the samples sent to Calcutta up to this date are worthless. The authorities here who had charge of the articles sent to the Exhibition of 1851 and the Paris Exposition of 1855 say the effect of these displays in improving the articles sent this year is evident. The native cloths and dyes especially show a great advance. It is a curious fact that the introduction of photography has induced the famous Delhi painters on ivory to use perspective and shading, which add immensely to the value of their landscapes. Several of the specimens sent are faithful copies of M. Beato's photographs. With these articles and the photographs now being made of the various tribes and castes of India, the English public ought to be able to form a vivid idea of the hitherto fabled East.

DISCUSSION ON GUNPOWDER.

At the regular weekly meeting of the Polytechnic Association of the American Institute on the 30th January, the discussion was resumed on the subject of the application of chemistry to the military art—this subject having been continued from the meeting of the previous week.

Prof. Joy—Three years ago, Mr. Bunsen, Professor of Chemistry in the University of Heidelberg, examined with great care the products of the combustion of gunpowder, and as the results were quite different from the statements of our text books, an account of them may interest this meeting. Bunsen found that of the substances formed by the combustion of powder, 67·7 per cent. are solid, and 31·24 per cent. are gaseous. The following is his list of both classes:—

Products of the Combustion of 100lbs. of Powder.—*Solids.*

Sulphate of potassa	42·20	
Carbonate of potassa	12·60	
Hyposulphite of potassa	3·20	
Sulphide of potassium	2·10	
Sulphocyanide of potassium	·30	
Nitrate of potassa	3·70	
Charcoal	·70	
Sulphur	·10	
Carbonate of ammonia	2·80	
		67·70
Gases.		
Nitrogen	9·90	
Carbonic acid	20·10	
Carbonic oxide	·90	
Hydrogen	·02	
Sulphide of hydrogen	·18	
Oxygen	·14	
		31·24
Total		98·94

As so large a portion of the powder is formed by combustion into substances which are solid, the gun would soon be completely filled up and rendered useless, were it not that most of the solids are thrown out by the expansion of the gases. Bunsen states the pressure at 4,374 atmospheres, 1,000 of which are due to the expansion by heat.

Bunsen's alalyses of the powder which he used showed it to be composed of the following substances:—

Nitrate of Potassa	79·99
Sulphur	9·84
Carbon	6·69
Hydrogen	·41
Oxygen	3·07
Total	100·00

Prof. Seely—I wouldask Prof. Joy, if the account gives the mode in which the powder was burned?

Prof. Joy—It was shaken from the end of a whip stock into a retort in such a manner that one grain was burned at a time. The gases were drawn by an aspirator into tubes from which the air had been expelled, and the tubes were sealed until the gases could be examined.

Prof. Seely—Bunsen's analyses are exceedingly interesting and instructive, but they do not prove that our old notions of the combustion of gunpowder, when burnt in the usual way in a cannon, are erroneous. The mode in which he burnt his powder would necessarily give different products. As there was no pressure in his retort, the temperature was very much lower than that at which powder is burnt in a gun. It is a well known law that the products of decomposition by heat vary with the temperature, and the higher the temperature the simpler the compounds. If the quarternary compounds of Bunsen's list were produced at the low temperature of his retort, we should naturally expect at the higher temperature of the gun the binary compounds usually described. That there is bisulphide of potassium left in the gun we know by the smell and taste. We should certainly not find at this degree of heat so unstable a compound as the carbonate of ammonia.

Mr. Rowell—It is necessary to understand the office of the several ingredients of powder before we can obtain substitutes for either. The use of the sulphur is to kindle the mass. It burns at a low temperature and gives out little heat in burning, but sufficient to ignite the charcoal. Then the heat from the charcoal completes the combustion and expands the gases. In this friction match you know there is on the outside a little phosphorus, beneath that a little sulphur, and beneath the sulphur the stick of pine wood. The phosphorus in burning generates but little heat, the sulphur some more, and the wood more still. In this cup I have a little alcohol of 95 per cent. If I light the match and dip it immediately into the alcohol while the phosphorus only is burning, you see that the alcohol is not ignited, but the match is extinguished. But if I wait till the sulphur gets to burning then you see the alcohol is set on fire. The wood in burning generates more heat than the sulphur, and I have found that in lighting an oil lamp it is necessary to wait till the wood portion of the match begins to burn, the sulphur flame not being sufficiently hot for this purpose.

Prof. Seely—Mr. Rowell's experiment is a very beautiful one, and demonstrates in the most satisfactory manner the fact that the flame of phosphorus is less intense than that of sulphur. At first sight this fact might seem to form an exception to the general law that the heat generated by the burning of any substance is in proportion to the oxygen which it consumes; for, a given weight of phosphorus in burning combines with one-eighth more oxygen than the same weight of sulphur. The equivalent of phosphorus is 32, and in burning it forms phosphoric acid, PO_5. The equivalent of sulphur is 16 and in burning it forms sulphurous acid, SO_2. So that while 32 parts by weight of phosphorus combine with 40 parts of oxygen, 16 parts of sulphur combine with only 16 parts of oxygen. The explanation is to be found in the fact that the phosphorus flame is diffused through a larger space than the flame of sulphur; and, consequently, though the quantity of heat is greater, it is less intense. The power of heat to set any substance on fire depends upon its intensity.

ON THE PRESENT STATE OF METEOROLOGY.

At a recent meeting of the Manchester Philosophical Society, Mr. Thomas Hopkins on this subject. In the paper the Author represented that certain recent meteorological writers had abandoned the Hadleian theory,—of winds being caused by the ascent of sun-heated air in the tropical regions, and its passage through the upper atmospheric space, to descend in the polar regions, and return to the tropics. It was shown that great efforts had been made in different countries to discover the causes of those atmospheric disturbances which often take place, without much uniformity in the conclusions arrived at. From extensive researches made by American observers, Commander Maury had attempted to prove that near to each tropic there was the crest of a large atmospheric wave, from which air flowed down toward the equator on one side, and towards the pole on the other; and that light air ascended from the surface in both the polar regions. Numerous English registrations have been placed in the hands of Admiral Fitzroy, who has not, like Commander Maury, promulgated a new hypothesis, but has exhibited what he considers the general action of cyclonic storms in middle latitudes; this is, however, opposed to the Hadleian theory. Sir J. F. Herschel, in his elaborate work "On Meteorology," omits to notice the disturbing influence of the liberated heat of condensing vapour on the gases; but he also abandons the old theory of winds, and attributes them to the actions of aqueous vapour in a new form. It is contended by the writer, that the great cause of atmospheric disturbance is to be found in the local heating of gases by the liberated heat of condensing vapour. It is then pointed out that the term "atmospheric wave" is founded on a false analogy, and leads the mind in a wrong direction. To speak of storms coming *from* a certain quarter also misleads, as the cause of storms is to be found in the part towards which the wind blows. In conclusion, it was suggested that aeronauts, when ascending into the higher regions to ascertain the state of the atmosphere in those regions, should, in addition to the ordinary instruments, use a wet bulb thermometer in conjunction with a dry one, in order that the hygrometrical state of the upper regions may be ascertained.

ON THE APPLICATION OF CHARCOAL TO THE VENTILATION OF SEWERS.

By H. Letheby, M.B., M.A., Ph.D., Medical Officer of Health, and W. Haywood, M. Inst. C.E., F.R.I.B.A., Engineer and Surveyor.

The following is a report just presented to the Commissioners of Sewers of the City of London:—

The experiment was suggested by the facts detailed in the Report of the Medical Officer on the Ventilation of Sewers, and on sewer gases, in 1858, wherein he described the powerful oxydising effect of charcoal as determined by the investigations of Lowitz, Saussure, Thenard, and others, at the beginning of the present century, as well as by the recent inquiries and practical results obtained by Dr. Stenhouse. All of these tend to prove that charcoal has the power of absorbing and oxydising the miasms of organic decomposition, when, with atmospheric air, they are passed over it. In commenting on these facts, it was remarked that in common wood charcoal there was evidently a powerful means of destroying the foul gases of sewers; and that the practical application of it was fortunately a question of but little embarrassment; for, to use the words of the report, "let the sewers be ventilated as they may, either by open gratings in the streets, or by the rain-water pipes in the houses, or by the pillars of the gas-lamps, or by tubes carried up at the landlord's expense, from the drains of every house, or by especial shafts in the public streets,—in fact, let the gases go out of the sewers how they will, and where they will, you have but to place a small box containing a few pennyworths of charcoal in the course of the draft, and the purification of the air will be complete. As far as we know, the strength and the endurance of this power is almost unlimited, so that when once the air filter has been set up, it will last continuously for years. Its action also upon the draft cannot be particularly injurious: and I have no doubt that the temperature of the sewers, and the agencies which are now at work in circulating the air, and ventilating them, will be sufficient to keep up a current of foul air through the filters; and if these were multiplied to a large extent, the friction of the gases upon the charcoal would be reduced to an insignificant amount."

Acting on this recommendation, the engineer was instructed to report on the practical capabilities of the suggestion; and he advised in his report of November 22, 1858, that the proper mode of ascertaining the cost and effect would be to select "a limited district; adapt the existing ventilators in the first place, add to their number, and perfect the system to such an extent as may be practicable; and watch, and record the results before adopting it for the whole city."

The district experimented upon is in the eastern portion of the city of London. It includes a space bounded by Bishopsgate Street on the west, from Cornhill to Widegate Street; Middlesex Street and Somerset Street on the east, to the city boundary; and by the Minories and then by Leadenhall Street to Cornhill on the south; the whole of the main thoroughfares above-named being included in the area. It comprises a space of about fifty-nine acres, with about 1,700 houses, and about 14,000 inhabitants.

This district was selected for various reasons; 1st, because the sewers have but a slight fall, and the currents in them are sluggish; 2nd, the area is densely populated, and has more than an average proportion of resident poor in it; 3rd, the thoroughfares are mostly narrow, and are therefore disagreeably affected by the sewer gases which issue from the ventilators; 4th, the district affords comparatively good means of isolation from other sewers.

The total length of sewers in the district is 25,587 feet. Upon this length there are 104 air-shafts, 265 gullies, 15 flushing-shafts, 4 tanks, and 26 side entrances.

The number and condition of the house drains entering the sewers are, upon the average, the same as those of other sewers within the city.

The whole of these sewers were isolated as far as possible, so as to prevent air currents passing through them either from or to the adjacent sewers; and, as we have said, the general arrangement of the sewers of the district admitted of such isolation being effected with considerable completeness, so that the sewers were dependent upon their own conditions for ventilation.

There were two varieties of mechanical arrangements adopted for applying the charcoal; one was patented by Messrs. Bean and Burge, which consisted of one large sieve with compartments, the other was an adaptation of our own, and consisted of a series of trays for holding the charcoal, and were so constructed as to be capable of being readily removed from the frames into which they fitted.

Wood charcoal was employed, broken into pieces of the size of a filbert. It was packed closely, but without compression, upon the various trays; and each tray held about $1\frac{1}{12}$ lbs. of charcoal, making altogether 6½ lbs., distributed over the six trays of each air filter.

The experiment was commenced on July 14, 1860, and is still in operation. It has, therefore, been continued for a period of rather more than eighteen months.

The points to which we have directed our attention are the following:—

1st. The deodorising power of the charcoal.

2nd. The length of time that the same charge of charcoal will continue to deodorise the sewer gases.

3rd. The effect the air filters have on the ventilation and temperature of the sewers.

4th. The exact cost of the experiment, so as to obtain data from which to estimate the probable expense of the process if it were applied to the whole City, or even to the Metropolis.

First, the deodorizing power of the charcoal has been satisfactorily proved to be complete. Not only have there been no complaints from the public of stenches from the ventilating gratings, but we have ascertained by actual observation that the odour of the sewer gases is not perceptible when they have traversed the charcoal. This, indeed, might have been predicated from the extensive laboratory experiments, and the other practical inquiries to which we have alluded.

Charcoal from the ventilators has been submitted to chemical examination after having been in action for from nine to twenty months, and when heated with water it yields abundance of alkaline nitrate, showing that some of the organic miasmata have undergone complete oxydation. But besides these compounds, others are present—namely, peculiar alkaline salts, which indicate the fixation not only of ammonia, but also of other volatile nitrogenous bodies which are peculiar to organic decomposition. The nature of these compounds has yet to be determined; for all that can be said of them is, that they have a remarkably bad odour, compounded of urine, sewage, bad meat, ammonia, and stale tobacco; attempts have been made to isolate them, but without success. This however is not surprising, when we consider that chemists have hitherto failed to separate and identify the miasms of organic corruption.

Guntz, for example, tried to collect the volatile matters of putrid flesh, but he only obtained a stinking alkaline liquor, that he could not analyse. Moscati condensed the organic vapour from the miasms of the pestilential rice-fields of Tuscany, but the solution which he procured defied investigation, notwithstanding that it was so highly charged with organic matter as to putrefy quickly. Rigaud did the same with the atmosphere of the marshes of Languedoc, and Boussingault with the air of some of the worst districts of Paris. We have ourselves sought for the putrid miasms which infect the over-crowded dwellings of the poor; and although the liquid obtained in each case is so charged with alkaline organic compounds as to blacken sulphuric acid, and reduce the salts of gold and silver, yet the nature of the miasms is still unknown. Graham thinks they are not actual vapours, but organic molecules, like the pollen of flowers, floating in the air. This was also the opinion of the late Dr. Wilson, of Edinburgh; and both of these chemists have adduced very cogent reasons for believing that the infection or disease-producing molecule is not volatile in a strict chemical sense, but is merely diffused by suspension in the atmosphere. This may perhaps be true of the actual morbific agent, but there are also organic vapours of an alkaline nature present in these miasms, which are the invariable products of putrefaction. As far back as the year 1849, the researches of Dr. Stenhouse into the products, of the decomposition of nitrogenous organic matters by heat, by acids, by alkalies, and by spontaneous decay, demonstrated that "whenever ammonia is generated in large quantities from complex substances (either animal or vegetable, it is always accompanied by the formation of a larger or smaller amount of volatile organic bases." Many of these bases he collected and obtained in the form of an oily liquid, but it was so difficult to separate them, that he was unable to determine their exact composition. More recently, Dr. Crace Calvert has examined the volatile alkalies from putrefying fish, and has found that they are very remarkable substances, containing carbon, nitrogen, hydrogen, phosphorus, and sulphur. Dr. Odling has also collected the alkaline emanations from sewage, and has ascertained that they are more complex than is usually supposed; for in addition to nitrogen and hydrogen, the constitutents of ammonia, they contain carbon. Let them, however, be what they may, either physically suspended organic molecules, or complex volatile alkalies; and be the morbific agent either the one or the other, there is in charcoal a perfect means of arresting and oxydising all the noxious compounds contained in these gases. This is demonstrated not merely by their absence in the sewer air which has passed the charcoal, but also by the presence of the alkalies and the changed molecules in the charcoal itself.

Second. As to the duration of the powers of deodorisation, we have hardly sufficient proof.

The charcoal appears to lose much of its power when saturated with water; and as the position in which the trays containing it are placed is such that leakage of water into them in times of rain is, to some extent, all but impossible; and as, moreover, the atmosphere of the sewers is always very moist, the charcoal becomes so wet as to require removal long before it has failed as a deodoriser. Upon an average the sieves have been recharged about once in three months. Those which have been in very wet situations have been re-filled much more frequently, and those in dry situations less.

If the situation of the ventilators could be arranged as to keep the charcoal dry, we are of opinion that it would not require renewal more frequently than once in a year, perhaps not so often; but, under existing circumstances, many of them require to be changed not less often than once a month. Secure situations might, however, be obtained by enclosing the charcoal in the lower compartments of the lamp-posts, and by other means which have been suggested in our previous reports, or by placing the ventilators against the sides of the houses, as in Philpot Lane. And here we may remark, that no apprehension need be felt of the escape of effluvium, for the experience of the last two years has proved, beyond all doubt, that this is impossible. We make prominent allusion to this fact because there was great opposition on the part of occupiers of houses when it was desired that the charcoal sieves should be placed against the outer walls of their premises; and we were, therefore, compelled, in arranging the experiment, to fix the filters in a much more expensive and inconvenient situation than we wished to do.

(*To be concluded in our next.*)

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

By Dr. F. Crace Calvert, F.R.S.

(*Continued from page* 123.)

Red dyes obtained from aniline called fuchsine, azaléine, roseine, &c.—The production of the fine colour, which bears the popular name of Magenta, was first observed by Mr. Natanson, in 1856, and more especially by Dr. Hofmann when preparing cyantriphenyl-diamine, by the action of bichloride of carbon on aniline. But it was first Mr. Verguin who first brought it forward to the trade as a dyeing agent, and his mode of preparation, which was patented in April, 1859, by Messrs. Renard and Franc, of Lyons, is the following:—Into a glazed iron pan are introduced 100 parts of analine and 60 parts of anhydrous bichloride of tin, and the whole is heated for 15 or 20 minutes, at a temperature of about 392°. The dark red liquor thus produced is left to cool, when it becomes thick and glutinous; it is then mixed with boiling water and filtered; to the filtrate is added chloride of sodium, which determines the precipitation of fuchsine, as it is insoluble in saline solutions. Magenta was afterwards prepared by C. Greville Williams, with permanganate of potash, and by Dr. D. Price, with binoxide of lead; nitric acid, and nitrate of mercury were also successfully employed. These different methods of preparing magenta were followed by several other patents, purporting to obtain the same results, and amongst them I may cite that taken on the 10th December, 1859, by Mr. Rudolph Heilman, in which the employment of arsenic acid is mentioned, and one also for the employment of the same agent on the 18th of January, 1860, by Dr. H. Medlock. As it is probable that this agent is the best suited for producing magenta commercially, I will give a sketch of the process. Dr. Medlock heats two parts of aniline with one of arsenic acid to about 250°, and when the red colour is produced, it is mixed with boiling water and allowed to cool. The red colour is thrown down by saline matter, washed, and dissolved in methylated alcohol, or the mass is digested in hydrochloric acid diluted with water, and the clear fluid solution is saturated with an excess of soda, which precipitates the colour, while the arsenious acid is held in solution by the alkali. Magenta is a rather powerful organic base, which is sparingly soluble in water, but its solubility is increased by the presence of an acid. It leaves a brittle mass, having a beautiful golden green metallic reflection when its alcoholic solution is left to spontaneous evaporation, and this is not peculiar to magenta, as the whole of the coal tar colours, when in a high state of purity, present the same appearance. Purple aniline differs from the red, not only in its composition, which is as follows:—

$$\overset{\text{Purple.}}{C_{36}\,H_{17}\,N_3\,O_2} \qquad \overset{\text{Red.}}{C_{36}\,H_{20}\,N_4\,O_4}$$

but also because the fuchsine dissolves in ammonia and in sulphuric acid with a yellow colour, and is discoloured by sulphurous acid, whilst the purple is unaffected by those re-agents. Silk or wool is dyed with fuchsine by simply adding some of the colour to a slightly acidulated bath. The dyeing colour of this material is so great that 10 grains will dye 2 square yards of silk,

Of late years many attempts have been made to fix another colour obtained from coal tar, called rosalic acid ($C_{12}\,H_6\,O_2$), but up to the present time I believe all attempts have failed, with the exception of rosalate of magnesia, which was employed for some time in calico printing.

Blue colouring matters from Coal Tar—I have already drawn your attention to the blue colouring matter patented by Mr. Girard, and carried out practically by Messrs. Renard and Franc, of Lyons. Mr. Lauth also has observed that if an alcoholic solution of red aniline, and especially azaléine, is heated with a reducing agent, such as protochloride of tin, or still better with aldehyde or hydruret of benzoïle, a blue colour is produced even at ordinary temperatures. This blue colour is soluble in water, alcohol, and acetic acid, but does not resist the action of mineral acids, alkalies, or light.

Mr. Willm has recently published an interesting paper on this aniline blue, which not only shows how aldehyde acts, but exhibits the composition of the blue itself.

$$2\,(\overset{\text{Azaleine.}}{C_{36}\,H_{20}\,N_4\,O_4}) + \overset{\text{Aldehyde.}}{5\,C_4\,H_4\,O_4} \times \overset{\text{Water.}}{8\,HO}$$
$$= \overset{\text{Blue or Oxyphenylanilide.}}{3\,(C_{34}\,H_{11}\,N\,O_2)} + \overset{\text{Acetate of Ammonia.}}{5\,C_4\,H_3\,(N\,H_4)\,O_4}$$

Therefore the triamine azaléine has been transformed into a monamine blue, by a new chemical reaction, for aldehyde not only acts as a reducing agent, but converts a part of the nitrogen into ammonia.

Bleu de Paris.—Recently, Messrs. Persoz, de Luynes and Salvétat, called public attention to a new blue which they had produced, and to which they gave the name of Bleu de Paris; this they prepared by heating for thirty hours, in a sealed tube, at a temperature of 356°, one part of anhydrous bichloride of mercury with two parts of aniline. The blue thus produced can resist the action of weak acids and alkalies, but assumes a red hue when acted on by these agents in a concentrated state. Sulphurous acid has no action upon it, and it dyes animal fibres with facility.

Bleu de Mulhouse. — MM. Gros-Renaud and Schaeffer have lately published an interesting process for obtaining from the red aniline, called azaléine, a purple and blue. It consists in dissolving in a litre of boiling water 50 grammes of white gum lac in powder, and 18 grammes of carbonate of soda, to which is added 50 grammes of an alcoholic solution of azaléine. After an hour's ebullition, the red colour is transformed into the Bleu de Mulhouse.

Azuline.—This beautiful blue colour, which resists the action of the strongest acids, and which was introduced into this country at the latter end of 1860, by Messrs. Guinon, Marnas, and Bonnet, of Lyons, is prepared by them from phenic acid, and, when pure, presents itself under the form of copper-bronze coloured crystals, soluble in alcohol, to which they communicate a magnificent blue colour, slightly tinged with red. The following is the process for dyeing silk and wool:—To an acidulated lukewarm bath of water an alcoholic solution of azuline is added, and the silk or wool worked in it until it is of the required shade. It is then transferred to another bath of boiling water, strongly acidulated with sulphuric acid, when the purple colour is dissolved, leaving a most brilliant and permanent blue upon the material. The dyed silk or wool is washed repeatedly, passed through a bath containing a little tartaric acid, and dried.

Chinoline Blue.—Mr. C. Greville Williams introduced in the spring of last year a fine blue colour, which he obtained by boiling together a substance derived from quinine or cinchonine, called chinoline, with iodide of amyl. The resulting product is boiled with water and then with potash for a quarter of an hour, filtered to separate the resinous matter, when a gorgeous blue is obtained, with scarcely any shade of red. This colour is so fugitive that its use has ceased.

Green Colours from Aniline.—Although it has been known to chemists that aniline would yield a green colour under certain oxidising agents, up to the present time all efforts to dye silk or wool commercially with it have failed, but to avoid having to refer to this green colour again, I may mention that Messrs. Samuel Cliff, Charles Lowe, and myself patented, on the 11th of June, 1860, a most easy and practical method of producing it under the name of *Emeraldine*, on cotton fabrics, specimens of which I have the honour to show you. The process consists in printing an acid chloride of aniline on a cotton fabric prepared with chlorate of potash, and in a few hours a beautiful bright green gradually appears, which only requires to be washed. If the green fabric is passed through a solution of bichromate of potash, this colour is transformed into a dark indigo blue, called by us *azurine*.

Napthaline Colour.—The beautiful solid hydrocarbon napthaline, which has yielded such a long category of substances to the chemists, has, up to the present time, yielded nothing of practical importance to the dyer, with the exception of a case which I shall mention presently. From it the following coloured derivatives have been obtained, namely chloroxynaphthalic acid, perchloroxynaphthalic acid, carminaptha, ninaphthalamine, nitrosonapthalin, napthamein, and a body of a purple colour. It is to Mr. Perkin that we owe the knowledge of several of these substances and their colour-giving properties. In my laboratory a fine purple colour has been obtained from napthalin, which dyes with facility silk and wool, and the process is so far perfected as to enable me to show you some silk dyed and a piece of calico printed with it.

A few months ago the scientific world were startled by the announcement from a French chemist named Z. Roussin, that he believed he had discovered the means of making from napthaline the important colour-giving principle which I have already mentioned to you when speaking of madder called alizarine, and what strengthened his belief was, that he thought he had succeeded in removing two equivalents of oxygen from binitronaphthaline, and transforming the nitrogen thereof into ammonia, leaving, as a residue, alizarine, as seen by his formula:—

Binitronaphthaline	..	$C_{20},\ H_6,\ N_2,\ O_8$
Minus oxygen	..	$-\ O_2$
Plus hydrogen	..	$+\ H_6,\ H_2$
EQUALS		
Alizarine	..	$C_{20},\ H_6\quad O_6$
Plus ammonia	..	$N_2,\ H_6$
Plus water	..	$2HO$

The simple process which he devised to obtain a crystalline substance which gave a red colour with an alumina mordaunt, consists in dissolving slowly binitronaphthaline in concentrated sulphuric acid, and raising the temperature gradually to 392°, when he adds granulated zinc in successive small portions. After a short time sulphurous acid is given off, and the conversion of binitronaphthaline into a red colouring matter is effected. All that is now required is to dilute the liquor with eight or ten times its volume of water, and carrying it to the boil, filter, and allow the whole to cool, when Mr. Roussin's so-called alizarine deposits under the form of fine red or orange-coloured crystals. Although this product possesses some properties similar to those of alizarine, it differs from it in many of its chemical reactions, and also because it does not furnish the purple and chocolate colours given by alizarine with iron, and iron and alumina mordaunts. Still these results, arrived at by Mr. Roussin, are so remarkable, that it is to be hoped that he will persevere in his endeavours to solve this interesting problem.*

---

* Those who may wish for further information on the subject of coal tar colours, should consult the number for

I cannot conclude this part of my paper without drawing the attention of those interested in the subject of colours, to a series of valuable papers, which have recently been published in the Memoirs of the Institute of France, by my eminent and learned master, M. Chevreul, on the comparative affinity of various colouring matters for different fibres, on the influence of various mordaunts, on divers colouring matters, and, lastly, on the influence of the solar light on such dyed fabrics.

Calico Printing.

The art of calico printing depends upon so many branches, of mechanical as well as of chemical science, that it is impossible for me to give detailed information of all the improvements which every department of this manufacture has undergone, during the period embraced by this lecture, but I shall draw your attention to a few of the prominent points that have come under my notice.

Engraving of Rollers.—This branch of calico printing has made great progress. Not only have the engravings acquired sharper outlines and finer details, but the methods of engraving have greatly multiplied. I may cite as instances the application of the principle of the pentagraph, by Messrs. Smith, so as to trace patterns on the surface of rollers. Also, calico printers have extensively availed themselves of Mr. Locket's improvements for producing the groundwork of prints, or, as they are termed, "covers," by applying "eccentric engr·ving," or etching, which produces with facility most complicated patterns on a varnished roller, by means of a diamond point guided by machinery. Another improvement, highly interesting in a scientific point of view, is the application of galvanism to the diamond tracer. By combining the galvanic action with an eccentric motion, most beautiful and delicate engravings may be produced. This is done by tracing the pattern with varnish on a zinc cylinder, which is so placed in the engraving machine that as a needle passes over its surface and comes into contact with the zinc, the galvanic current is established, and by simple machinery causes the diamond to trace the corresponding pattern on the copper roller. The communication is so rapid and precise that a great saving of time is effected. But if mechanical art has greatly assisted the engraver, chemistry has rendered him equally important services, by enabling him to abandon costly and cumbrous modes of impressing by force the designs on the cylinder, substituting for them a great number of etching processes. By some of these processes, as by every other addition to the resources of the engraver, an entirely new and beautiful class of engraving is produced, unattainable by any other known means. For instance, owing to various improvements, rollers of forty-three inches in circumference, and forty-four inches long have been introduced, enabling the calico printer to produce cheaply large furniture patterns.

En passant, I wish to call your attention to an application which has been made of a process greatly admired by many of you at the Exhibition of 1851, invented by Mr. John Mercer, the eminent calico printer, by which the beauty of dyed and printed goods was increased by passing the cotton fabrics through a strong solution of caustic lye, and afterwards through a weak solution of sulphuric acid, and then thoroughly washing. If this process has not been generally adopted, it is no doubt owing to the contraction which the cotton fibres experience under the above chemical influences, but the increased strength which the fibre thus acquires has been turned to good account, by enabling the printer to use it as a substitute for what is technically termed the "blanket" that is an endless cloth which passes over the engraved rollers with the goods to be printed. This material is found by its strength to resist better than most others the heavy strain which the blankets have to undergo during printing.

Singeing.—I shall here also allude to two improvements effected by Mr. John Thom, of Manchester. The first, applicable to all kinds of cotton or woollen fabrics, destined for printing or dyeing, consists in an improvement in the singeing or removing the nap from fabrics. The usual mode is to pass the fabrics either through a gas flame, or over a semi-circular heated iron plate. In the latter case, however, a large amount of fuel was wasted in maintaining the heat of the plate, owing to the free radiation of heat into the atmosphere, and to its absorption in the currents of cold air in contact with the plate. Mr. Thom's invention remedies these defects, by enclosing the plate under a brick arch, so that no air can enter the chamber except that which passes with the piece, and that limited quantity is, by a proper arrangement of flues, conducted into the furnace which heats the plate. The drawing which I have the pleasure to show you will fully explain this arrangement.

Sulphuring.—The second improvement of Mr. Thom was devised some years ago, but it is only recently that it has come into general use amongst printers. It is especially applicable to mixed fabrics, such as *mousselines-delaine*, which require, after they have been singed and before they are printed, to be bleached. This was formerly effected by hanging, for several hours, the moist pieces in chambers filled with sulphurous fumes, and is now performed by Mr. Thom's process in a few minutes by passing them over a number of rollers confined in a chamber filled with the same vapours.

Thickening Substances.—It will be readily understood that it is necessary that the mordants or colours to be printed, should be of sufficient consistency to remain on those parts of the fabrics when they are left by the rollers, so as to produce sharply-defined patterns, and as a great variety of chemical products are employed a great variety of thickeners becomes also necessary. Thus flour, starch, farina, various natural gums, albumen, lactarine, gluten, and several preparations of flour and starch called calcined farina, and patent gums are used. For details of the improvements effected in patent gums I must refer you to the lecture which I had the honour to deliver on the 21st December, 1852, before this Society.

(*To be concluded in our next.*)

MEETINGS FOR THE WEEK.

Mon.—*United Service Inst.*, "The Protection of the Bottoms of Iron Ships from Concussions and Fouling," by R. Mallett, Esq., J. Grantham, Esq., and Mr. T. B. Daft, at 8.30 p.m.
Medical Soc., General Meeting, at 7 p.m.
London Inst., "On the Grecian Drama, with Readings from Original Versions and Choral Illustrations," by the Rev. C. M. Davies, A.M., at 8 p.m.
British Architects, at 8 p.m.
Soc. of Engineers, "On Trussed Beams," by W. Parsey, Esq., at 7 p.m.
Tues.—*Inst. Civil Engineers*, I. "Description of the Loch Ken Viaduct, Portpatrick Railway," by Mr. E. L. J. Blyth, M. Inst. C.E. II. "The Centre Pier of the Bridge across the Tamar, at Saltash, and the Means employed in its Construction," by R. P. Brereton, Esq., at 8 p.m.
Royal Inst., "On Sound, and the Special Organs and Sense of Sight in Man and Animals," by J. Marshall, Esq., at 3 p.m.
Wed.—*Society of Arts*, "On the Progress of British Commerce during the last Ten Years," by Thomas Ellison, Esq., at 8 p.m.
Geological Soc., "On the Permian Beds of Westmoreland, Cumberland, and Dumfriesshire," by Prof. R. Harkness, F.G.S. II. "On the Position of the Pteraspis-beds, and on the Sequence of the Old Red Sandstones of South Perthshire," by Prof. R. Harkness, F.R.S., F.G.S.
Thur.—*Royal Inst.*, "On Heat," by John Tyndall, Esq., at 3 p.m.
Soc. for the Encouragement of the Fine Arts, Conduit St., "Pictorial Readings of Poetry," by the Rev. H. Hutton, at 8 p.m.
Royal Soc., at 8.30 p.m.
Fri.—*United Service Inst.*, "The Motion of Projectiles fired from Rifled Ordnance, and the Advantages obtained by the Employment of such Pieces," by Major C. H. Owen, R.A., at 3 p.m.
London Inst., "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.
Royal Inst., "On the Distribution of Northern Plants, as influenced by Climatal and Geographical Changes," at 9 p.m.

TO CORRESPONDENTS.

Received.—S. W., S. P., H. M., C. J. R., T. S., E. M., G. W., T. M., W. W., M. R., J. A. B., W. C., R. R., C. W., J. C. G., H. J. W., C. L. P., in our next), Captain S. (in our next), J. A. D., W. H. E. (in our next), J. B. (declined), R. M. (shall be sure to receive it early), J. H. E., R. P. E., I. N., W. P. B., Captain N., "Artillery Officer," (see Captain Halsted's reply.)

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

VELOCITIES OF LIGHT IN DIFFERENT MEDIA.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Mr. J. Alexander Davies, in the Mechanics' Magazine for the 21st of February, writes that he is almost compelled to look upon a statement of mine as an oversight, which consists essentially of the two following propositions:

I. That according to the corpuscular hypothesis regarding light, the velocity of light is greatest in the most highly refracting media.

II. That experiment has proved, on the contrary, that the velocity of light is least in the most highly refracting media.

I shall not waste time and space by giving demonstrations of these propositions, but shall merely refer to sources of information where the best demonstrations of them may be found.

I. The proposition that, according to the corpuscular theory of light, the velocity of light must be greatest in the most highly refracting media, being, in short, proportional to the refractive index, is demonstrated by every writer on that theory who has investigated its consequences with precision, from Newton to the present time. The following are the best authorities to which I can at present refer:—Newton's "Principia," Book I., Propositions 94, 95; Poisson, "Traité de Mécanique," Book II., Chap. III., Section III.; Sir John Herschel's Treatise on Light, in the "Encyclopædia Metropolitana," article 534, and a few of the preceding articles. I may observe, that a very moderate knowledge of the principles of dynamics is sufficient to enable any one to test the demonstration for himself.

II. Setting aside indirect proofs, the *direct* experimental proof that the velocity of light is least in the most highly refracting media, was (being, in fact, inversely, as their refractive indices) first accomplished by the celebrated M. Léon Foucault, in a series of experiments described in the "Comptes Rendus" of the French Academy of Sciences, for the 6th of May, 1850 (Vol. XXX., page 551), and also in the "Annales de Chimie et de Physique, Vol. XLI., page 129.

A concise statement of the whole question, both as to theory and as to experiment, is contained in the opening address of the President of the Royal Society, Lord Wrottesley, delivered on the 30th of November, 1855, on which occasion M. Foucault received the Copley Medal. (See the "Proceedings of the Royal Society," Vol. VII., No. 17.)

I am, sir, your most obedient servant,
W. J. Macquorn Rankine.

Glasgow, Feb. 22, 1862.

DIVING BELLS AND SUBMARINE OPERATIONS.

Spring Gardens, London, 25th Feb., 1862.

Sir,—I read in your number for Saturday last, a very interesting article on submarine operations, by Mr. Andrew Brown, and without in any degree wishing to detract from the merit of Mr. Brown, my object in writing this letter is merely to supply some additional information connected with the application of the diving bell to building under water, which perhaps Mr. Brown may not be aware of. As far as my researches go the first time that the diving bell was employed for building under water was at Ramsgate Harbour in the year 1813, when the East Pier Head having failed it was necessary to rebuild it in a depth from 10 to 17 feet at low water of spring tides, and the late Mr. Rennie being the engineer-in-chief of that harbour at that time, introduced the diving bell for that purpose; he therefore designed a bell of an oblong form, which was made of cast iron, having a sufficient number of solid ground-glass circular lights fixed in the roof of the bell to afford the requisite light to divers when working in the bell. In the centre of the top of the bell was fixed a watertight gun-metal nozzle to which a leathern hose was attached, the other end of the hose being connected with a double-barrelled air pump, by means of which the requisite supply of air was sent down to the divers in the bell. There was a valve in-

---

tober, 1861, of the quarterly journal of the Chemical
ciety, which contains a valuable paper by Mr. W. A.
kin.

side the bell by means of which the quantity of air to be supplied was regulated, and which closed, in the event of any accident occurring to the hose or nozzle, so that the water could not enter; beneath this valve there was also a strong shackle to which any weight could be attached.

The bell was worked by travelling trams fixed above, which could be worked in any direction as desired, according to the form and nature of the work to be executed below, which was entirely directed from above, so that the divers in the bell were only required to adjust the stones to the joints, whilst the bell, the divers in it, and the stone attached to the roof of the bell, were raised or lowered together as desired, according to a code of signals which were worked by striking a hammer in the bell. The whole of this diving bell apparatus answered admirably, and the work performed by it under water was equally well done and almost as rapidly as above. Mr. Rennie also employed the diving bell and apparatus in a similar manner, but entirely afloat, in a properly constructed barge or vessel for that purpose. These "universal cranes," as they may strictly be termed, since that period have come into general use, and are adopted in almost all building operations.

After the completion of the Pier Head at Ramsgate Harbour, the diving bell and apparatus was employed by Mr. Rennie for similar objects at Kingstown, Howth, Holyhead Harbour, Sheerness, and a variety of other places with equal success.

I am, Sir, your humble servant,

John Rennie.

◆

THE THREE LINES OF THE PORTSMOUTH DEFENCES.

Sir,—The editor of the *Times* in a long article, informs us that the diameter across the outer line of defence, is nine miles, so that a shell that can be thrown four miles, cannot reach the central portion of the defences. It is quite clear that such a shell cannot, but what will be said of the bolt which Mr. Lynall Thomas threw from his rifled cannon, more than five miles and three quarters, such a bolt can have a chamber drilled in its front, to contain a charge of liquid fire (phosphorus dissolved in bisulphide of carbon), its burning quality intensified by other mixtures, after the manner of the steel bolt that I used from a two-grooved military rifle at Cork, 1852, as reported by Colonel Beamish, in his letter to the editor of the *United Service Journal*, August, 1852. The *Times* also informs us that it would take the entire army of England to efficiently man the three lines of fortification. This being so, is it not incumbent on Lord Palmerston to countenance the Irish Volunteer movement, or at all events to patronise the arming of 600,000, sinewy Irishmen ("instinctively belligerents") with assagais, after the manner of the "indomitable Caffres." J. Norton.

◆

THE PROJECTED CHANNEL RAILWAY.

Sir,—In your Paper of the 14th instant, there is a letter from Mr. Leonard Foster, in which allusion is made to a lecture which I recently delivered upon Mr. James Chalmers's project for a "Channel Railway" to unite England with France. The writer of the letter wishes to discourage the project, but endeavours to do so in a rather Hibernian manner, for he first declares his belief that the scheme is impracticable, and yet goes on to argue that if made the Channel Railway would not pay. If the scheme be impracticable, what need of further argument? Mr. Foster has only to prove his first proposition and there is an end of the matter, But as he finds himself unable to put this effectual extinguisher upon the project, he tries to show that the capital required cannot be raised; then, feeling that this argument also is weak, his last resource is a simple expression of his own opinion that people would not travel by the Channel Railway even if successfully accomplished.

Now, Sir, a project of national importance like that of Mr. Chalmers'—a project which would confer such immense advantages upon the people of England and France, indeed, upon the inhabitants of the whole of Europe, is not to be dismissed upon such flimsy reasoning as that indulged in by Mr. Foster. The importance and value of a railway communication between the two countries have long been recognized by the great minds of England and France; and any proposal for effecting this desirable union at a reasonable cost is as least worthy of careful and serious examination. Let us however take Mr. Foster's observations in his own order — first that the scheme is impracticable. This has yet to be proved; for I do not know that any one has up to this moment been able to demonstrate that it is not practicable; but I apprehend that the fact can be ascertained at 'vely small cost by actual experiment on a reduced scale: and I suppose Mr. Chalmers is quite willing to have his scheme thus tested. If the method of joining the tubes under water be found to be effectual the stabilty of the structure may be relied upon; for there will not be, as Mr. Foster puts it, a mere iron tube between the passengers and the sea, but also an embankment of stone and earth 15 to 20 feet thick, and, if necessary, an inner lining of two or three feet of brickwork.

Then as to the commercial value of the undertaking. No one who knows anything of the Continent and its productions and can appreciate the facilities for a highly remunerative traffic which the Channel Railway would open out, can doubt of its success as a paying speculation if no more than twelve millions be expended in its construction. At this moment a railway is being made in London at a cost of more than a million a mile; it will be in competition with another line and with the river and omnibus traffic; yet its promoters are confident of its success The Channel Railway, for its peculiar traffic, could have no competitor. Having been entrusted for several years with the active part of the management of the South Eastern Railway's Continental business, I am able to form some idea of the impetus which would be given to foreign travel and trade on both sides of the Channel, were this communication made; but I believe the most sanguine estimates would be as far exceeded in this case as they were in the case of the first railways. The traffic, too, would be of the best paying description; not minerals at ½d. per ton per mile but first-class passenger traffic and light valuable merchandize, mails, bullion, parcels, &c.; and this not to and from France alone, but to and from the most distant parts of Europe. The new Commercial Treaty with France has already more than doubled our exports. What would they be were this Railway completed, and that Treaty changed to absolute free exchange of products, which would certainly follow? Mr. Foster speaks of the passenger traffic between England and France being greatest in the summer months, when he adds, "the sea is generally calm." Just so, this is exactly the reason why the traffic is limited to the summer. The "sparkling waves" are very pretty viewed from the shore; but how few dare trust themselves upon them! And although the attractions of Paris are at their height in winter they are not sufficient to induce the many to brave the horrors of the passage over the "sparkling waves." It may sound very dreadful in some ears to talk of passing through a "dark hole filled with mephitic vapours;" but put it to a poor sufferer while being tossed over the "sparkling waves," whether he so admires their beauties that he would rather prolong his enjoyment for a couple of hours, than be snugly seated in a comfortable carriage passing over the same space in thirty minutes, and what would be the reply? All sane people will readily imagine the answer. Besides, the darkness and mephitic vapours only exist in the fancy of Mr. Foster. Locomotive engines are now constructed to consume not only their own smoke, but their own steam, and the tube would be both lighted and ventilated. Why the very tube itself would be an attraction — thousands would come from all parts of the globe merely to have the gratification of seeing and passing through so great, so wonderful a work.

It is a curious coincidence that the writer of the Emertonian Prize Essay on the advantages of a close alliance between France and England, knowing nothing of Mr. Chalmers's proposal estimates the annual saving to this country alone from such an alliance at exactly twelve millions; so that in one year the whole cost of the Channel Railway might be recovered by a mere mutual undertaking of good faith; but the Railway itself would form a material bond of amity such as no paper guarantee could ever secure. Then let our Government institute a proper inquiry into this proposal; let them appoint a commission of competent persons with sufficient funds to test the practicability of the scheme; and if they pronounce that it literally will "hold water," there will be no want of capital to construct the Channel Railway, nor of passengers to use it.

I am, Sir, your obedient Servant, H. Cook.

Whitehaven, 25th February, 1862.

◆

TURBINES.

Sir,—In answer to R. E. B's first question, "If a turbine with a fall of 100ft. and supplied by a 1in. pipe, be equal to 4 horses' power, would a turbine with a 25ft. fall and supplied by 4 pipes 1in. diameter, and of the same diameter, be equivalent? Certainly not.

The power of a turbine is in terms of the height of fall, and the diameter of the centre of the buckets of the revolving ring, consequently it is immaterial whether the turbine be supplied by one or twenty, provided the one pipe be of proper dimensions. The answer to the second question is that no such hydraulic effect could be produced. S.

Bermondsey, Feb. 25, 1862.

Gossip.

◆

Mr. Frederick Hodges, of Lambeth Distillery, has just added to his powerful fire-extinguishing apparatus a steam fire-engine, manufactured by Messrs. Lee and Larned, of the Novelty Iron Works, New York. Since its arrival it has been several times under steam, and performed some wonderful work. We are informed that a public trial of its capabilities will shortly be held under the direction of Mr. Charles B. King, engineer, of London.

Mr. J. A. Davies, in a letter, says:—"It is not my province to remark upon the social absurdities of the age, yet I am desirous, especially as the question of the healthfulness of railway travelling is just now afloat, of directing your attention to that notorious omnibus defect and absurdity, the rattling of the windows, which could of course be remedied by placing some soft substance upon one of each of the parts which come in contact. Methinks that the proprietors of the "busses" will have much to answer for in the shape of disordered brains.

On Thursday evening last the Horological Institute celebrated their third annual dinner at the Freemason's Tavern, the Lord Mayor occupying the chair. A larger number sat down to dinner than at any preceding meeting. We regard this as an evidence of the increasing interest felt in the prosperity of the Institute. The Lord Mayor, in proposing the toast of the evening, "Prosperity to the British Horological Institute," said he was afraid that, from his ignorance of the subject and its great importance, he would fail in doing it full justice. He felt he was addressing no ordinary gathering. Among the one hundred gentlemen before him there were no doubt many men of mark, for the institute comprised men who devoted their lives not only to labour but to study. The manipulations they performed were of the highest order of mechanical excellence. Perfect exactness was what they aimed at, and the delicacy of the operation must necessarily raise the mind of the operator. It was not merely that they made wheels and put them together, but they did for the world that service which enabled it to be exact.

Mr. Dyer made some remarks at the last meeting of the Manchester Philosophical Society, relative to the first invention of the electric telegraph, and read the following extract from Arthur Young's "Travels in France" (2nd edition), London, 1794, which proved that electricity had been employed at that early date for the purpose of transmitting intelligence. "In the evening to Mons. Lomond, a very ingenious and inventive mechanic, who has made an improvement in the jenny for spinning cotton. Common machines are said to make too hard a thread for certain fabrics, but this forms it loose and spongy. In electricity he has made a remarkable discovery. You write two or three words on a paper; he takes it with him into a room, and turns a machine enclosed in a cylindrical case, at the top of which is an electrometer, a small fine pith ball: a wire connects with a similar cylinder and electrometer in a distant apartment, and his wife by remarking the corresponding motions of the ball, writes down the words they indicate, from which it appears that he has formed an alphabet of motions. As the length of the wire makes no difference in the effect, a correspondence might be carried on at any distance; within and without a besieged town for instance, or for a purpose much more worthy, and a thousand times more harmless, between two lovers prohibited or prevented from any better connection. Whatever the use may be, the invention is beautiful. Mons. Lomond has many other curious machines, all the entire work of his own hands. Mechanical invention seems to be in him a natural propensity."

The advanced and ever advancing taste of the people of this country is exemplified most palpably year by year in the improved design and character of valentines. Those whose ages will enable them to take a retrospective survey of, say, a quarter of a century, will remember the wretched specimens of art which even in fashionable society once passed current as valentines. Ill-drawn, and worse coloured, illustrations, with doggerel lines, called poetry, to match, constituted the valentines of other days. But now the change which has come o'er the spirit of the time is made sufficiently plain by the expositions in our stationers' windows of graceful productions, at once creditable to the mechanical and the artistic skill of the people of England. The number of persons employed in the production of these love tokens is prodigious, whilst the Post Office returns reveal their effect upon the revenue.

What a record of inventions, says *Trench*, in his "Study of Words," is preserved in the names which so many articles bear of the place from which they first came, or the person by whom they were first invented The "magnet" has its name from Magnesia. The "bayonet" tells us that it was first made at Bayonne; "worsted" that it was first spun at a village of the same name, near Norwich; "cambrics" that they reached us from Cambray; "damask" from Damascus; the "damson," also, is the Damascene or Damascus plum; "dimity" from Dumietta; "cordwain," or "cordovan," from Cordova; "currents" from Corinth; "indigo" (*indicum*) from India; "agates" from a Sicilian river, Achates; "jalap" from Xalapa, a town in Mexico; "parchment" from Bergamum; the "guinea" that it was originally coined, in the year 1663, of gold brought from the African coast, so called; "camlet" that it was woven in part, at least, from camel's hair. The fashion of the cravat was borrowed from the Croats, or Crovats, as they used, in the sixteenth century, to be called. Such has been the manufacturing progress of England that we send our calicoes and muslins to India and the East. Yet the words give standing witness to the fact that we once imported them from thence; for calico is from Calicut, and muslin from Maussul, a city in Asiatic Turkey. "Ermine" is the spoil of the Armenian rat.

At the last monthly meeting of the Liverpool Polytechnic Society, Captain Walker, late of the Great Eastern, read a paper, descriptive of the last voyage of the "big ship," which sailed from Liverpool on the 10th of September, for New York. He stated that with the exception of shipping the crew, the arrangements for the voyage were made independantly of him. His narrative of the voyage, so far as it went, differed little from the statements which have long since been published. He confirmed the statements as to the excessive rolling of the ship, but added almost nothing to the details previously given as to the series of disasters which brought the voyage to an abrupt termination in Cork Harbour, instead of at New York He refused, however, to indorse the claim so generally and so strongly put forward by Mr. Towle, as the inventor of the means by which the great ship was eventually steered into Queenstown. After Captain Walker's paper had been read, Mr. James Smith described "A plan for steering the Great Eastern without a rudder." The plan consisted in the adaptation of tubes placed at a certain angle across the after-part of the ship, forming a junction where they intersect each other about the middle of their course. Into these tubes the water of the ocean is to be introduced, and its flow inwards and outwards would be so regulated by steering apparatus as would guide the course of the vessel. It was stated that the floating fire-engine on the Thames is propelled and steered on this plan.

The Philadelphia journals say that the coal oil of Pennsylvania is rapidly becoming one of the important elements of our industry and wealth. It is scarcely three years old, and even now it bids fair to rival the coal trade itself. The following statement of the shipments on the Philadelphia and Erie Railroad alone will give a comparative idea of the increase of this trade:—In 1859, 525 barrels; in 1860, 21,794 barrels; in 1861, 134,927 barrels; while for the first month of 1862 the total shipments on this road have been estimated at 30,000 barrels. Large as the business and the increase on this railroad has been, it is estimated that it shews but little more than one-sixth of the business actually done. Large quantities of the oil were taken to Pittsburg by way of the Alleghany River, and thence to Philadelphia by the Pennsylvania Railroad. The Erie Extension Canal carried large quantities to Erie, whence it found its way to the Eastern market by the lake and the railroads in North-western Pennsylvania. It is stated on good authority that the wells on Oil Creek yield 75,000 barrels of crude oil per month, which would be 900,000 per annum. What the yield of the whole oil region in this State will be during the present year cannot be definitely ascertained, but it must reach very considerably over a million barrels o crude oil, for new wells are continually being opened and the trade is making the most astonishing strides, and promises greater wonders still. It has no parallel in this country or in the world, except the Californian gold fever, which it rivals in speculation and excitement. The crude oil, it is said, involves an expense of about 10 dols. per barrel in purchasing barrels, transportation, refining, &c., so that the actual expenditure on 1,000,000 of barrels would be 10,000,000 dols. per annum. The region of country in which such immense wealth is now being developed was, before the excitement caused by "striking oil," comparatively thinly populated, and much of it a wilderness, but now it is becoming thickly settled, and new towns are springing up, and old ones growing into greater proportions. This will make that section one of the most flourishing in the commonwealth, while all the oil seeking an Eastern market and an outlet for Europe must greatly benefit and increase the trade of Philadelphia, the emporium of the State."

A New Gun Metal.—The *Messager du Midi* states that the new guns introduced by Austria on board her vessels, and the composition of which had been hitherto kept a secret, are cast in an alloy called Aich metal, from the name of its inventor. This alloy is composed of 600 parts of copper, 382 of zinc, and 18 of iron. It is exceedingly tenacious, can be easily forged and worked, and will bear a considerable inflexion when cold without breaking, its resistance being greater than that of iron of the best quality.

New Substitute for Silver.—An improved combination of metals for the production of a white alloy, resisting the action of vegetable acids, has been provisionally specified by Mr. B. F. Trahue, of Nimes. The alloy is formed by the combination of Banca tin, 375 parts; nickel, 55 parts; regulus of antimony, 50 parts; and bismuth, 20 parts=1000 parts. A portion, say, one-third of the tin, is placed in the bottom of the crucible, of suitable dimensions, with the nickel, antimony, and bismuth; over this is placed a second third of the tin, and the whole is covered in by a layer of crushed wood charcoal to the depth of about half an inch. The crucible being closed with its lid is brought to a red-white heat. Its contents are then sounded with a hot iron rod, to ascertain if the nickel is reduced; after which the remainder of the tin is passed through charcoal, and the fused mass is stirred constantly until the combination of the metals is complete, when it is run into ingots or other forms.—*Mining Journal.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 1969, 1979.
Boilers and their Furnaces, &c., 1972.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1963, 1995, 2002, 2003.
Ships and Boats, including their fittings, 1954, 1975.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 1970, 2007.
Food and Beverages, including apparatus for preparing food for men and animals, 1953.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1968, 1988, 1989, 2008.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 1961, 1962, 1965, 1966, 1973, 2022.
Lighting, Heating, and Ventilating, *None.*
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1957, 1959, 1960, 1991, 1993, 2004, 2006.
Metals, including apparatus for their manufacture, 1958, 2020, 2023.
Chemistry and Photography, 1956, 1978.
Electrical Apparatus, 1994.
Warfare, 1964.
Letter-Press Printing, &c., *None.*
Miscellaneous, 1951, 1952, 1955, 1971, 1974, 1976, 1977, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1990, 1992, 1996, 1997, 1998, 1999, 2000, 2001, 2005.

1951. J. Turner and R. B. Dunnett. *Improvements in stamping, endorsing, and embossing machines.* Dated Aug. 6, 1861.

Here the inventors secure near the top of an ornamental stand or pedestal, a stud or pin, to which they attach a toothed wheel, and joint or hinge a lever; to this lever they secure other two or more studs or pins to carry an equal number of toothed wheels, left free to revolve on their centres, geared together, and to the fixed wheel above referred to, as secured to the stud in the stand or pedestal. To one of the wheels free to revolve on their centres, by preference the one furthest removed from the joint or hinge, they affix an arm to carry the engraved, embossed, or otherwise ornamented stamp or die. *Patent abandoned.*

1952. F. Tolhausen. *Mechanical contrivances increasing the effect of motive power.* (A communication.) Dated August 6, 1861.

For the purposes of this invention the patentee has combined an apparatus in which the crank with its dead points is entirely dispensed with. This apparatus consists of a toothed wheel which, whilst rotating, receives its impulsion at any point of its circumference or rotation except that portion which is termed the dead points. The said wheel has inclined or ratchet teeth, into which a pair of racks with trundle or round teeth are made to gear, the racks being set together in a frame, one on each side of the wheel, and parallel to the reciprocating motor from which the rotation is derived. Thus, supposing the two racks to have a simultaneous and identical reciprocating motion given to them, for example, by means of the piston rod of a steam-engine, one of the racks will gear into the whee teeth, and set the wheel to rotate, whereas the other rack will escape in the manner of a click and ratchet, and on the return stroke the rack first mentioned will escape, and the second rack will continue the impulsive motion, both of the racks being set movable in their frames, and kept in gear with the wheel by springs or any other equivalent yielding device. *Patent completed.*

1953. J. McMorran. *Improvements in the construction of machines for mincing meat and other substances.* Dated August 6, 1861.

This invention comprises various improvements (which we cannot here particularise) upon that class of mincing machine wherein the meat, &c., is cut by being forced by revolving pins or propellers against stationary knives between which the propellers revolve. *Patent completed.*

1954. E. A. Cowper. *Improvements in protecting ships of war and land batteries from the effects of projectiles.* Dated August 6, 1861.

This consists, 1, in fixing a certain thickness of a softer metal on the face of the protecting plates of ships-of-war, &c. 2. In so connecting the edges of the plates that no plate can be forced in below those next it until a large amount of metal has been destroyed altogether in its form or sheared in two. This is effected by boring holes at the junctions of the plates, cutting a strong female screw in such holes, and screwing in strong plugs so as to entirely fill the holes. *Patent abandoned.*

1955. A. A. R. Damoiseau. *Improvements in apparatus for drawing blood or other fluids from the human or animal body.* Dated August 6, 1861.

This consists in drawing off or abstracting blood or other fluids from the human body by a suitably constructed cupping glass or glasses in combination with an air-pump or other similar apparatus, and arranged so that an alternate lifting and depressing or expanding and contracting of the skin of that part of the body to which the cupping glass or glasses are applied is to take place, with the object of preventing the choking up or obstruction of the pores, scarifications, or other capillary openings through which the blood or other fluid to be abstracted from the body is to flow into the said cupping glass or glasses. *Patent completed.*

1956. W. Clark. *Improvements in bleaching and clarifying saccharine matters and in apparatus for the same.* Dated August 6, 1861.

This consists mainly in treating saccharine juices of all kinds, either in a heated or cold state, by animal black in a state of fine powder, together with argillaceous or other earths; stirring up the mixture with a suitable agitator. After stirring for a certain time, the juices are bleached by fine black argillaceous or other earths, and one or several jets of steam introduced into the mixture, which produces a violent effervescence, and sets the whole mixture in motion, and after continuing this for a certain time the juices will become bleached. A mechanical agitator may be used as well as the steam jets to produce more complete agitation of the liquid. *Patent completed.*

1957. A. V. Newton. *Improvements in the construction of reversible seats* (A communication.) Dated Aug. 6, 1861.

This consists first in connecting the seat back to the seat so that the position of the seat will be shifted by reversing the back. The invention is not fully described apart from the drawings. *Patent completed.*

1958. P. Spence and J. Mellor. *Improvements in separating copper from its ores.* Dated August 6, 1861.

Here the inventors submit the ores in combination with an acid or other substance capable of acting after the same manner to the action of heat in a furnace, so that a condition of copper soluble in an acid is produced, which solvent is subsequently added. The ores as they come from the manufacture of sulphuric acid, or in their native state (after washing) are ground previous to placing them in the furnace. *Patent abandoned.*

1959. F. Silverston. *Certain improvements in watches.* Dated August 6, 1861.

This consists in so arranging the works of a watch as to allow the balance to work below the surface of the top plate. *Patent completed.*

1960. W. H. Richards. *A new and useful or improved combined knife and spoon for camp or other purposes.* Dated August 7, 1861.

This invention is not described apart from the drawings, *Patent completed.*

1961. D. Miles. *Improvements in the construction of window sashes.* Dated August 7, 1861.

The patentee claims the combination of parts tied or kept together by metallic tongues, forming when complete a rigid and secure window sash, and permitting, on the withdrawal of the said metallic tongues, both the upper and lower sashes partially to revolve, in order that either side of the glass may be cleared from the interior of the room or chamber at pleasure. Also the combination of parts in using which he dispenses partly with the metallic tongues for the lower sash, or for both upper and lower sashes, and uses a spring catch, or two spring catches, in lieu thereof, also the combination of parts by which he causes both upper and lower sashes to present singly or together either face of the glass to the interior of the chamber, substituting the use of spring catches in lieu of metallic tongues. *Patent completed.*

1962. N. A. Lenner. *A new system of covering for houses and other buildings and coverings.* Dated August 7, 1861.

This consists principally, in giving to bricks, tiles, &c., by grooves, notches, or niches cut in dovetail, the faculty of being set and fixed rapidly, solidly, and economically. *Patent completed.*

1963. E. T. Hughes. *An improved wheel-barrow waggon.* (A communication.) Dated August 7, 1861.

This consists in making the shell or mouth parts of the barrow capable of swinging on studs, or on a spindle attached to the framework so that, when it is to be emptied, it can be upset in the same way as the ordinary street waggon used by excavators. *Patent completed.*

1964. M. A. F. Mennons. *Improvements in certain* *descriptions of breech-loading fire-arms.* (A communication.) Dated August 7, 1861

The patentee claims the substitution to the ordinary lock mechanism with external hammer in Lefaucheux and similar breech loading fire-arms, of a percussion spring, enclosed in the stock settings, and so combined with the trigger as to ignite by an upward stroke the fulminating priming of the cartridge. *Patent completed.*

1965. W. R. Rogers. *Improved machinery to be employed in the application of dowels to woodwork.* Dated August 7, 1861.

This relates, 1, to an arrangement of machinery for hanging together, under pressure, the parts intended to be secured by dowels. For boring dowel holes at any required distance apart in the pieces to be united, the inventor fits a boring machine with clamps, which clamps the work, and presents it either sideways, or endways to the action of the rotary cutters. On a cast-iron main frame, fitted with parrallel guides, he mounts a sliding table, or frame, which carries a pair of adjustable swivel clamps. These clamps are made to advance to, and recede from each other by a right and left handed screw shaft, mounted in the sliding frame, and operated by a hand-wheel. They are held firm by clamping into, which, when slackened, will allow of the clamps receiving a quarter turn. Thus the clamps may be made to face each other, and embrace a piece of wood that is to be presented endwise to the cutters, or to face the cutters and present the work sideways to the cutters. The clamping jaws are operated by vertical screws. The cutters, which he proposes generally to use in pairs, are fitted to cutter spindles, mounted in adjustable socket bearings that slide by a right and left handed screw shaft, on a horizontal slide bar, for the purpose of adjusting their distance apart. *Patent abandoned.*

1966. T. G. Webb. *Improvements in the manufacture of articles of glass.* Dated August 7, 1861.

This relates to a method of facilitating the adaptation of the "posts," or pontils to articles of glass previous to finishing or melting. With this view, the patentee places the article upon a table, which is provided with apparatus for insuring a certain position in relation to parallel guides against which the "post," or "pontil" is placed previously to its being pressed forward. For these guides he uses rollers, and so constructs the apparatus which regulates the position of the article that it may be adjusted to suit different sizes or shapes. As a modification of the above he can, in like way, cause the article to be moved up to the "post," or "pontil" sideways *Patent completed.*

1968. J. Eastwood and T. C. Eastwood. *A new kind of yarn called "Gorilla yarn," and the cloth woven therefrom called "Gorilla cloth."* Dated August 8, 1861.

This consists in mixing knotted, or lumped noils, or knots, or lumps of silk of various colours with fibrous substances, and spinning the same into a yarn, having knots, or lumps of silk fixed therein, and weaving the said yarn into a cloth, or fabric. *Patent completed.*

1969. N. D. P. Maillard. *Improvements in self-acting and inexhaustible hydraulic and atmospheric motive power engines.* Dated August 8, 1861.

This consists in a method of obtaining from, or by the use of cold water, or any other suitable fluid, at its natural temperature, or from common atmospheric air, motive power engines, which are applicable to all the purposes for which steam engines are now employed. *Patent completed.*

1970. J. Gedge. *An improved apparatus for beating or threshing grain.* (A communication.) Dated Aug. 8, 1861.

This apparatus is constructed as follows:—On two uprights of a framing the inventor places a cross piece, or yoke, and under the yoke is a board, the face of which is covered with plane tables, or small shelves forming rods in position of inclined planes, to suit the inclination of the apron on which they act. This assemblage of rods he terms a beating or threshing hammer. Two grooves are made in, or on the uprights, in which slide the ends of the hammer. An apron, on an incline, is sustained in position by cross pieces, so that it may receive the stroke of the hammer. This apron is so arranged as to hold the grain for beating, and afterwards to pass it off. The hammer is raised by the action of four (more or less) wings, which are brought into action by turning a handle, each end of each wing lifting the hammer as the wing rotates. *Patent abandoned.*

1971. J. Coldwell and W. Coldwell. *Improvements in the manufacture of sheep shears.* Dated August 8, 1861.

Here the inventors propose to use for the blades bars of iron in combination with steel, welded thereto by forging or tilting, and reduced to the proper size by rolling each of the blades. They can then form them at one heat. For the bow and shanks they use iron rolled to the proper size for the purpose; this iron they can weld to the blades and forge hollow for the shanks at one heat; the remaining processes are performed in the ordinary way. *Patent abandoned.*

1972. R. Jakes. *Improvements in puddling furnaces.* Dated August 8, 1861.

The object of this invention is to preserve, as far as practicable, the cast iron basin, and inside lining or fitting of a furnace. This the inventor accomplishes by arranging a series of tubes or pipes parallel to each other, and adapted in length to the plan of the bottom in such manner that the ends of the pipes are connected within the boundary of the bottom by cross pipes, which renders the whole continuous. The first pipe is connected by a cross length at the end opposite the inlet orifice to the parallel pipe next to it. This pipe is again connected to it at the same end as the inlet orifice with the pipe next in succession, and so on, in order that the water or air flowing through or injected into the pipes traverses the whole space or area of the bottom, and passes off by the outlet pipe. *Patent abandoned.*

1973. W. S. Hogg. *Improvements in the construction of doors, gates, and shutters, principally applicable for fire-proof buildings.* Dated August 8, 1861.

This consists in forming the above mentioned articles of parallel iron or other metal bars, rebated or grooved to receive bricks or other moulded forms of earthen materials. The parallel iron bars are combined with an external iron framing of the form and size desired. *Patent completed.*

1974. R. De Clercq and E. Chazelles. *A new system of machines to raise water or any other liquids, called fly-wheel pumps or hydraulic fly-wheel.* Dated August 8, 1861.

According to this invention the water is raised by the rapid rotation of a wheel, arranged with certain cylinders and pipes, the water being powerfully forced towards the circumference of the wheel by the wheel's rotation. We cannot give space to the details. *Patent abandoned.*

1975. G. H. Bovill. *Improvements in the construction of vessels, and in apparatus for vessels of war, also in the manufacture of wrought-iron boilers, girders, and ships, and in the manufacture of iron plates for the same.* Dated August 8, 1861.

Among the most important features of this invention are the following:—1. Applying vulcanised india-rubber to the seams of the planks and decks of ships. 2. Applying magnetic or galvanic electricity in order to prevent adhesion to the bottoms of ships, in such manner as to produce electric currents through the metal plates forming or sheathing a ship's bottom. 3. Propelling and manœuvring ships by forcing out water through pipes or apertures placed as far below the surface of the water as practicable. 4. Arming ships of war with telescopic martello towers, cylindrical in form, and made of wrought-iron plates. 5. Using armour-plates for the sides of ships with flanges at two opposite edges, the flanges being connected by bolts or rivets, or welded when set in position. *Patent completed.*

1976. A. V. Newton. *Improvements in the construction of sewing machines.* (A communication.) Dated August 8, 1861.

This relates to certain improvements in the details of sewing-machines whereby their action will be materially improved. To this end it is proposed to introduce improved tension apparatus, whereby a large amount of slack thread may be thrown off to form the slack loop through which the shuttle passes, thus allowing, among other advantages, of large-sized shuttles being conveniently used. The invention is not described apart from the drawings. *Patent completed.*

1977. A. V. Newton. *An improvement in single-thread sewing-machines.* (A communication.) Dated August 8, 1861.

The object of this invention is to give security to seams formed by the tambour single-thread sewing-machines, and prevent them from unravelling or ripping up when from any cause one stitch has given way. To this end it is proposed to introduce into the line of stitches at suitable intervals short stitches, which will serve to retain the loop of an adjacent long stitch that may have been set free within its own loop, the shortness of this latter having the effect of binding on the loop that has been set free by the break in the combination of stitches. The short stitches may be thrown into the work alternately with the long stitches, or at every third stitch, or at any other suitable interval, but in practice it is preferred to make a short stitch after every long one. In order to adapt the single-thread machine to this kind of work, the back traverse of the feeding bar is arrested after the formation of, say, every second stitch by a cam, which receives rotary motion from the loop shaft. The feeding bar being thus arrested will make a proportionately short forward traverse, and thereby feed the cloth the proper distance for throwing in the short stitch. *Patent completed.*

1978. L. Le Paige *Improvements in treating fatty and oily matters obtained from wash waters, to deprive them of their smell.* Dated August 8, 1861.

For this purpose the inventor subjects the fatty and oily matters to the action of gases or vapours obtained from nitric and sulphuric acids. *Patent abandoned.*

1979. H. Kinsey. *Improvements in steam engines and boilers.* Dated August 8, 1861.

Here the patentee arranges the slide valve to work in a plane at right angles to the length of the cylinder, and the valve face he forms at one end of the cylinder. The trunnions he places at the same end of the cylinder, their centre line being in the plane of the valve face. The valve rod projecting from the valve box at one or both ends will then, as the cylinder rocks, move with it, its outer end or ends describing an arc of a circle. The valve rod, as its end is carried to and fro with the cylinder, is governed by a curved course, which pushes the valve to and fro over its seat as required to drive the engine. The curved course is stationary when the engine is at work, but it is capable of pivotting about a point in the centre line of the trunnions; this motion brings up another portion of the curved course which is of such a form as to cause the engine to work backwarks in place of forwards. In constructing steam boilers, he forms them of two cylinders of different sizes, placed vertically and concentrically with a water space between them; the interior of the inner cylinder forms the fire-box, the fire being supported on a circular grating. The fire is fed by a passage formed through the side of the boiler through the two cylinders and the water space, and this passage is fitted with a fire-door. The two cylinders are closed at their upper ends, the ends of the outer cylinder being at a distance above that of the inner cylinder with a water space between the two. The chimney or flue passes out through this water space, it being placed in the centre of the top of the boiler. Within the fire-box there is an inverted cone suspended by pipes from the top water space, and these pipes keep the cone constantly supplied with water, and allow the steam generated in it to escape to the top of the boiler. The bottom of the cone is connected by a pipe or pipes with the water space at the side of the boiler, so as to permit a free circulation of water through the cone. *Patent completed.*

1980. G. Haycraft. *Improvements in powder flasks.* Dated August 9, 1861.

Here the neck of the flask is formed by a tube which projects up from the flask; this tube projects down a short distance into the flask, both ends of the tube are open, and the end of the tube exterior of the flask is closed by a lid or cover similar to an ordinary cannister cover. Within the tube, and fitted closely to it is a second tube; this second tube is closed at the bottom, and open at the top, extending at a short distance above the first tube; in the top of the inner tube are two notches, into which a rib or projection on the interior of the top of the cover enters, so that the inner tube may be turned round by turning round the cover. Apertures are formed through the sides of the lower part of each of the tubes, and when the inner tube is turned so that the apertures on the two tubes coincide, and the flask is inverted, the powder in the flask passes through the aperture, and fills the inner tube; if the inner tube is then turned, so that the apertures shall not coincide, powder in the inner tube will be prevented from passing back into the flask and the charge contained in it may be withdrawn by taking off the lid. The inner tube is prevented from dropping through the outer tube by a pin on the inner tube passing through one of the apertures on the outer tube or otherwise. *Patent completed*

1981. A. J. Mott. *An improvement in or application to casks and other vessels, by which beer and other liquids can be withdrawn or forced from the said casks, without allowing the air to come in direct contact with the said liquids.* Dated August 9, 1861.

Here the object is to prevent air coming in contact with fermented liquids, when contained in vessels in limited quantities for domestic use; and the invention consists in allowing the atmosphere to exercise a pressure on one side of a travelling medium interposed between such liquids and the air, which travelling medium will give or transmit the said atmospheric pressure to the liquids. *Patent completed.*

1982. C. P. Moody. *Improvements in the construction of gates.* Dated August 9, 1861.

The present invention is for improvements upon a former invention for which letters patent were granted to the present patentee, the 12th day of December, 1860, (No. 3030), and consists in the means of securing and fastening the horizontal bars and uprights by hoops or straps of iron or steel, which he carries outside the uprights on both sides of the gate, and tightens up by wedges or screws. He carries screws, bolts or rivets through the straps or hoops, and into or through as many of the horizontal bars and uprights as may be found necessary to give solidity to the gate. *Patent completed.*

1983. J. Hemingway. *Improvements in machinery or apparatus for working coal, ironstone, or other minerals.* Dated August 9, 1861.

This consists in a series of revolving drills or augers arranged in a suitable frame, and driven simultaneously by steam or other power, or by manual labour. These drills are to be furnished with cutters of various dimensions and shapes. The drills may be applied and worked in any number which may be found most convenient, and their action regulated at the pleasure of the person working the machine. The machine may be applied to the driving of headings or straight work as well as to the working of coal or other material, or by making suitable variations in the mode of application. *Patent completed.*

1984. L. Vassiviere. *A smoke-consuming apparatus.* Dated August 9, 1861.

The position of this apparatus is on the furnace under the boiler (where furnace and boilers are used) and forward of the furnace bars. The smoke should be made to pass this apparatus at its lower part, it then ascends into small round holes made quite through the thickness of the inferior plate; from thence the smoke passes through a nipple, round which circulates heated air which meeting at the summit of the nipple the smoke mixes therewith, and furnishes the latter with the oxygen required to establish combustion. This mixture traverses an upper plate (which is placed on the hollow nipple to receive its tube); this is also provided with a round hole; between this upper plate and the nipple a space of about the eighth of an inch is left to let the heated air pass to supply the required oxygen and establish combustion of the smoke, which operation takes place immediately above the space mentioned and in the hole of the upper plate, which is sufficiently heated to ensure the inflammation of the mixture. *Patent abandoned.*

1985. J. Griffin and C. Griffin. *New or improved machinery for the manufacture or cutting of corks and bungs.* Dated Aug. 9, 1861.

A knife supported horizontally has a rapid reciprocating motion given to it by the means hereafter explained. The piece of cork to be made into a cork or bung, is supported between two centres, and is made to rotate slowly. The centres supporting the piece of cork are in a line parallel or nearly parallel to the edge of the knife, and at a distance from the said edge equal to one half the diameter of the cork or bung to be cut, and while the said piece of cork slowly rotates, the rapidly revolving knife cuts the cork into a cylindrical or slightly conical figure. The knife and the centres carrying the piece of cork work independently of each other. The said knife is moved rapidly backwards and forwards by means of a connecting rod actuated by a crank made in or fixed on an axis situated at right angles to the line of the knife's motion. A rapid rotatory motion is communicated to the said cranked axis by hand or other power. *Patent abandoned.*

1986. H. Chatwin. *Certain improvements in the manufacture of card, needle, pin, and other cases, and in the application to such articles of a new branch of ornamental art not hitherto applied to those goods.* Dated August 9, 1861.

Here the inventor prepares from pure deal, lime tree, or other suitable wood or material, the sides of such cases, and on the one side he secures the edges and top and bottom parts with glue; and over this he secures the other side again, using strong glue. The case thus made is shaped in any desired form. The cases are then cut open, and around the division he places a lip or framing of thin bone, ivory, metal, &c., and finishes this mounting around the same shape as the internal and external form of the case, with the exception that he allows the mounting, of whatever material it may be composed, to project according to the thickness of the material. The parts thus prepared he unites when required with a suitable hinge joint at the back, and spring snap in front. He next applies (if so desired and arranged) a glass panel or panels containing a photographic picture, and thus treated the case is fit for receiving the leather or other covering. *Patent completed.*

1987. A. V. Newton. *Improved machinery for sewing.* (A communication.) Dated August 9, 1861.

This relates, 1, to the use of an adjustable needle-bar guide box, by which the vertical needle, whether coarse or fine, can be brought to any required proximity to the shuttle and shuttle race. 2. To the use of a needle guard, by which the needle will be protected from being struck by the shuttle in its forward movement. 3. To the throwing out of action of the presser foot. The invention is not described apart from the drawings. *Patent completed.*

1988. C. Lee and T. K. Mack. *An improvement, or improvements in backing or covering the backs, or foundations of raised and cut pile fabrics.* Dated August 9, 1861.

This consists in enamelling, or japanning the backs of raised pile, or cut pile fabrics, as plush, velvet, coach lace, &c. These materials, thus coated, have the resemblance and waterproof nature of leather on the one side, whilst retaining their natural appearance on the other. *Patent completed.*

1989. J. Gray, T. Kershaw, B. Crowther and A Dean. *Improvements in mules for spinning.* Dated August 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1990. R. A. Godwin. *Improvements in pumps.* Dated August 9, 1861.

Here the inventor uses a cylinder mounted in a horizontal position, and having a piston fitted into it. Near each end of the cylinder a suction pipe enters it, passing through the side of the cylinder; each of these suction pipes is fitted with a valve opening into the cylinder. The ends of the cylinder are closed, and the piston-rod is worked through a stuffing box in one of the ends, and through the ends of the cylinder the exit passages are formed. These are fitted with valves opening outward. These valves are kept as low down as possible to allow the whole of the water the cylinder contains to run out. *Patent completed.*

1991. A. F. B. Falgas. *Improvements in the composition of bandages for hernias and of hypogastricks girdles.* Dated August 9, 1861.

The object here is to afford means whereby the wearer may place or adjust the pad or cushion of the truss, bandage, girdle, or belt, at any suitable inclination. The patentee uses an arrangement or apparatus constituting a ball and socket adjustment or arrangement in which a ball or a spherical or rounded knob or head fits in a socket cup or rounded recess (rotula or ball and socket fashion) and which is so combined with the pad or cushion of the truss, bandage, girdle, or belt, that the wearer can readily place or adjust such pad or cushion at the desired inclination or position and retain it there by a screw. *Patent completed.*

1992. G. H. Birkbeck. *Improvements in the construction of tents for military and other purposes.* (A communication.) Dated August 9, 1861.

In constructing a tent for four persons, three uprights are driven into the ground about two feet apart. These uprights may be in two parts formed with sockets or joints to connect them, and have hooks near the centre for supporting the metal rods to which one end of the cloths or hammocks are attached. The upper ends of the uprights are connected by the rods, which also serve to support the outer covering of the tent. The other end of each cloth or hammock is attached to a metal rod, formed with eyes or other connections at each end; this rod, when the hammock is to be used, is firmly screwed to the upper edge of the knapsack by straps or other fastenings, which thus forms a bearing or support for the foot, or lower end of the cloth or hammock, so as to raise it above the ground. Ropes are attached to each end of the rod, which fixes it to the knapsack, the ends being tightly stretched up to a peg, which is firmly driven into the ground. Two or more such cloths or hammocks may thus be stretched, and supported side by side (according to the number of uprights employed), corresponding ones being stretched and supported from the central uprights in the opposite direction. Each cloth or hammock thus supported forms a dry and flexible bed or surface, on which the soldier can repose with ease and comfort, without being exposed to the weather, or the injurious effects of lying upon damp ground, while the space underneath the hammock forms a shelter for the arms, provisions, &c. The cloth or covering of the tent is cut in a rectangular form, so as to shut in the tent at the side, by falling almost close to the side, to protect the men against the heat of the sun, rain, &c., and the parts thus forming the cover are furnished with buttons, hooks, or other fastenings, to connect them together, and the various parts can, in case of need, be employed as sacks or receptacles for the use of the commissariat, or for luggage. The whole of the parts are capable of being rolled together to form a package of limited size, which may be carried on the knapsack. For the use of cavalry or travellers, a light portable metal support may be substituted for the knapsack, suitably constructed to fold up, or attach to the hammock. *Patent completed.*

1993. A. S. Stocker and A. R. Stocker. *Improvements appertaining to horse shoes, boot-heels, wheel tyres, rails, safes, and other useful purposes.* Dated August 10, 1861.

Here the patentees take puddled bars or plates of wrought iron and place them in the ordinary converting furnace, and operate upon them in the same way as is generally practised. These bars or plates are intended only to be partially converted, so as to leave the inner part of the metal in a fibrous condition, whilst the outer surface or surfaces are hardened to a greater or less depth, and on one or more of its surfaces as circumstances may require. They then next form them into a pile of any desired number also of suitable length, breadth, and thickness; they then heat the pile to a fusing or welding temperature, and pass it through an ordinary rolling mill, whereby the whole becomes thoroughly incorporated and welded together in one solid mass and rolled out to the dimensions requisite for the purpose. *Patent completed.*

1994. H. Wilde. *Improvements in electro-magnetic telegraphs, and in apparatus connected therewith.* Dated August 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

1995. W. S. T. Clark. *A railway break.* Dated August 10, 1861.

This consists in intersecting the axle or axles of driving wheels of locomotives transversely, with a current of electricity, and intersecting the axle or axles of the locomotive, and the axles of the tender and carriages, and the axle or axles of the locomotive, and the axles of the tender, luggage vans, guards' vans, waggons, or trucks transversely, with a single or with separate currents of electricity, whereby most efficient grip or bite on the rails will be obtained. *Patent completed.*

1996. T. Schneider and C. E. Crawley. *Improvements in inlaying wood, ivory, and other substances, and in apparatus employed therein.* Dated August 10, 1861.

For this purpose the inventors take a veneer (which, to facilitate the description, they assume to be black) of the wood or other material, and they place it on a sheet of metal from which portions have been cut corresponding in form with the parts which are required to be removed from the veneer, the said sheet of metal being fixed on a suitable base to retain in their place any parts which may have been separated in producing the pattern, and over the veneer they place another sheet of metal, on the surface of which punches are fixed exactly corresponding in form and position with the parts to be removed from the veneer, this plate is put correctly in its position, so that the punches come correctly over the corresponding recesses in the first plate by guide-pins. The plates are then pressed together until the veneer is cut, when they are again separated, the hollows in the first plate will be filled with portions of the veneer, which have been forced into them by the punches, whilst on the upper plate, and clinging around the punches, will be the veneer to be inlayed, perforated in the way required. *Patent abandoned.*

1997. A. Barclay. *Improvements in machinery or apparatus for raising, lowering, or moving heavy bodies.* Dated August 10, 1861.

Under one modification this crane consists of a main pillar or column, fitted in a footstep bearing, and movable or not about its axis. This pillar has jointed to it a jib extending upwards in angular direction, and having jointed to its free extremity a secondary jib or beam, which sustains the load to be raised or moved. This secondary jib or beam is jointed to the main jib at about one-third of its length from the upper extremity, which is connected to the main pillar by a connecting rod or radius bar. A pulley is fitted to the lower end of the secondary beam, over this the chain to which the load is attached is carried, and this chain is carried up over a pulley at the junction of the secondary beam and the radius bar, and down to an ordinary winding barrel, which is fitted to the main pillar, and may be actuated either by hand or steam-power. The hoisting chain is wound round the front of the barrel, and there is a second chain for drawing in the main jib, which is wound on a duplex barrel in a direction contrary to that of the twisting chain. The free end of this second chain is attached to the upper end of the jib, where it is jointed to the secondary beam. The winding barrel on which the hoisting chain is wound is made with a second barrel, which runs loosely upon it, but is caused to rotate with the primary barrel by a clutch actuated by a hand lever. To raise the load, the primary barrel is put in motion, then if the second barrel is put into gear, the main jib is quickly drawn in, and the load moves inwards in a horizontal line, in readiness to be at once deposited in the truck, waggon, or other receptacle placed in readiness to receive it. *Patent completed.*

1998. M. Wigzell. *A machine or apparatus for twisting ordinary nails and other similar driving articles of a parallel or tapered form, and of a plain, fluted, grooved, or indented section throughout or in part.*

This apparatus consists of an arrangement of spur or other toothed wheels, and friction rollers of a parallel, conical, or other suitable form, for twisting screws with or without nuts or mandrils, or other shaped pieces worked by a rack or racks, or other gearing moving on suitable guides, and working on the necessary bearings, and arranged on suitable stands or beds, and driven by requisite driving wheels and pulleys, to which motion may be given by any known power. *Patent completed.*

1999. M. Wigzell. *A machine, apparatus, or machinery, for making plain twisted nails, spiral fluted nails, and other similar driving articles of a twisted or spiral fluted form throughout or in part.* Dated August 10, 1861.

This machine is capable of making one, or more nails at any number of revolutions, or parts of a revolution of its driving gear, and when the bars, rods, strips, or wire of iron, steel, or other metal are placed in the machine, they are drawn into their required position between the grippers at intervals, by machinery, or by hand, then gripped and cut off into the required lengths, and held by jaws which are placed on the ends of traversing and rotatory mandrils, then headed by hammers, or press rods, and twisted by the traversing and revolving mandrils which draw the pieces of iron, when cut as described, through rollers in front of the grippers, so as to give them the required number of twists. The nails when thus made, drop out of the jaws, which open when the mandrils have travelled their full distance. *Patent completed.*

2000. H. Greaves. *Improvements in apparatus to be employed for the water conveyance and delivery of coals and other materials.* Dated August 12, 1861.

This consists in the arrangement of a pontoon vessel or raft, on which the inventor places one or more lines of railway suitable for receiving trucks, carts, or waggons in which the coals or other materials are placed, and in which they are conveyed from the place of arrival to that of their destination. *Patent abandoned.*

2001. A. Garrend. *A new or improved apparatus for scraping wood of any kind, especially applicable to dye woods.* Dated August 12, 1861.

Here the patentee employs a tool carrier or kind of cylinder, having the form of an archimedian screw, on the projections of which cutters are fixed in any suitable way. By imparting a rapid rotatory motion to the cutter cylinder the wood as it is fed into the apparatus will be instantly cut up. *Patent completed.*

2002. W. E. Gedge. *Improved breaking apparatus for railway and other vehicles.* (A communication.) Dated August 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2003. W. Edwards and E. Edwards. *Improvements in or apparatus applicable to the breaks of railway carriages.* Dated August 12, 1861.

The inventors construct, and by suitable bearings attach to and under the floor of the carriage, connected with the usual buffers, or with the buffer springs of the carriage, or with additional buffers or buffer springs for the purpose, and also with such breaks as may be desired to be used or applied, an apparatus which, upon the shutting off of the steam, or upon reversing the engine attached to the train, or upon any other powerful arresting cause, acts on the whole of the breaks fitted to such carriage, and the train is very speedily brought to a stand. After applying the power of the engine or other means, and communicating back motion for the purpose of shunting on to a siding, or otherwise, the whole of the breaks become released, and cease to act or retard the motion of the carriage. *Patent abandoned.*

2004. A. Solomons. *A new or improved article of female apparel.* (A communication.) Dated Aug. 12, 1861.

This invention consists in forming in one article a bodice and skirt, as hereafter described. The bodice proper encircles, and is secured on the body of the wearer by any suitable fastening; it extends upwards to any height desired, but terminates in front at the waist, while the sides and back are carried outward from the body, and are kept extended by metal springs, whalebone, or other suitable stiffening agent. The skirt or petticoat, whether hooped or otherwise, is sewn or attached in any other convenient manner to the bodice, so as to form one article of apparel. *Patent completed.*

2005. V. Jankowsk. *Improvements in means or apparatus to facilitate the sawing of wood, and other substances.* Dated Aug. 12, 1861.

One end of the saw is fixed in a holder, passing through a guide connected to a spring, which the inventor prefers to be of vulcanized India-rubber. The saw thence passes through a suitable hole in a table, adapted to support the material to be cut, and it is then at its other end retained in another holder passing through another guide, and connected by a link to a crank-pin, having a pulley upon its axis, with a band operated by another pulley, by preference of larger diameter, upon the axis of which is placed another pulley, still larger, and this pulley is caused to revolve by a band from another larger pulley, the axis of which is formed with a crank operated by a treddle. *Patent abandoned.*

2006. J. H. Elvans. *An improved steel busk or stay fastening.* Dated Aug. 13, 1861.

This consists in constructing a steel busk or stay fastening, opening down the centre, and so arranged to readily fasten and unfasten by three catches locking on to a spring slide. *Patent abandoned.*

2007. J. Humpage. *A new or improved reaping and mowing machine.* Dated August 13, 1861.

The platform or base of this machine is supported upon two wheels, upon which wheels the machine is moved when in work, and from the axis of one of these wheels the motions of the several moving parts of the machine are taken. On the axis of one of the said wheels are two cams, one cam being in the form of a wheel, on the periphery of which a zig-zag depression is made. The toothed knife or sickle which cuts the wheat or grass is situated horizontally at a short distance above the ground, and has a reciprocating horizontal motion given to it by a stud on the end of a horizontal lever, engaging in the zig-zag depression in the cam, the knife or sickle being jointed to the said lever. When used as a mowing machine, the cut grass falls over a bar connecting the two wheels, the platform, which is movable, being taken away. When used as a reaping machine, the cut wheat is received upon the platform, and two vertical gathering forks approach, one on either side, and, closing upon the cut wheat, take hold of it, and by retiring, carry the wheat from off the platform; the forks open, and deposit the wheat in a sheaf for binding. *Patent abandoned.*

2008. J. C. Horner. *Certain improvements in looms for weaving.* (A communication.) Dated August 13, 1861.

This consists, 1, in applying a partially rotating motion to a double or compound shuttle-box, the position of the shuttle-box being governed by a pattern-wheel, furnished with two or more rows of holes or pegs; the pattern-wheel is put in motion by a ratchet-wheel, or other equivalent, actuated by any convenient moving part of the loom. The invention refers, in the second place, to looms in which a drop shuttle-box, with six or other convenient number of compartments, is used; the position of this shuttle-box is governed by a pattern-drum, which is moved round, or to and fro, by ratchet-wheels and catches, or other equivalents. The fingers acting in combination with the pattern-drum traverse from one side of the loom to the other on a slide. To the drop box is connected a rack, in which a pinion gears; this pinion is worked by ratchet-wheels, the catches of which are put in motion, when required, by pegs on the pattern-drum. The third part of the invention is similar to the second, and is chiefly adapted to looms in which a drop shuttle-box with four compartments is used. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Nov. 6, 1861.

2786. H. D. Bradt, Boston, U.S. Certain new and useful improvements in machinery for lasting and pegging shoes. (A communication.)

Dated Jan. 18, 1862.

136. W. Tice, 18 Downham-road, Islington. Improvements in gas regulators and meters, part of which invention is also applicable for covering various descriptions of metal spindles.

Dated Jan. 25, 1862.

194. C. West. 2 Derby-street, Westminster. Improvements in the insulation and covering of wire, and in the preparation of the materials for insulating the same.

Dated Jan. 29, 1862.

236. J. B. Harby, Leytonstone, Essex, rope maker. An improved method of preserving electric telegraph cables and wires.

Dated Jan. 31, 1862.

262. P. Scheurweghs, distillator, and A. J. A. H. de Boisserolle, manufacturer, Paris. Certain improvements in treating fatty and oily matters for obtaining their acidification, and in the apparatus employed therein.

Dated Feb. 1, 1862.

272. J. Pendlebury, Dukinfield, Chester, engineer. Improvements in the method of and apparatus for lubricating steam engine cylinders, slides, and other surfaces.

274. J. Deprez, Anzin, France, engineer. Improvements in machinery or apparatus for extracting coal, ores, and other mineral substances from mines.

Dated Feb. 3, 1862.

288. W. Clark, 53 Chancery-lane, engineer. Improvements in processes for preserving and colouring wood, denominated xylochromic and xyloplastic processes. (A communication.)

Dated Feb. 4, 1862.

292. P. Gardilanne, Dax, France, gentleman. Improvements in the manufacture of metallic wire fencing.

294. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in the manufacture of hard and soft soaps, and in the preparation of liquids for washing linen and other textile fabrics. (A communication.)

296. W. W. Williamson, High Holborn, mechanical engineer. Improvements in apparatus for drying clothes and fabrics.

Dated Feb. 5, 1862.

306. W. Campion and H. Johnson, Nottingham, sewing and stitching machine manufacturers. Improvements in machinery or apparatus for making the welts of hose or other articles made of looped or knitted fabrics, applicable also for other purposes.

Dated Feb. 7, 1862.

322. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in stereoscopic albums, books, and cases. (A communication.)

324. P. Shaw, Edinburgh, gentleman. Improvements in lamps.

326. W. E. Gedge, 11 Wellington-street, Strand. An improved portable thrashing and winnowing machine, and apparatus for working same by horse-power. (A communication.)

328. W. Clark, 53 Chancery-lane, engineer. Improvements in preserving timber, which are particularly applicable to the timbers of ships or other maritime structures. (A communication.)

330. W. H. Bartholomew, 2 Warwick-villas, Leeds. Improvements in barges or vessels suitable for the navigation of canals and rivers.

Dated Feb. 8, 1862.

332. J. S. Woodhouse, Cheapside, warehouseman. Improvements in hooped skirts.

336. J. Webster, Birmingham, engineer. An improvement or improvements in the manufacture of certain descriptions of nails, bolts, spikes, and pins.

Dated Feb. 10, 1862.

338. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in the treatment of coprolites and other fossil phosphates of lime. (A communication.)

340. J. Dickson, 66 Tollington-road, Holloway, gentleman. Improvements in voltaic apparatus and in the production of voltaic electricity.

342. J. Busfield, Bradford, York, worsted spinner, and J. Eastwood, machine maker. Improvements in machinery or apparatus for preparing wool for dyeing and spinning.

344. L. R. Bodmer, 2 Thavies-inn. Improvements in hydraulic oil presses.

346. J. Danka, 56 Webber-row, Waterloo-road, mat and matting manufacturer. Improvements in the manufacture of door mats and hearth rugs.

348. A. Munck, master mariner, and H. A. Myhre, watchmaker, Berners-street, Oxford-street. Improvements in ships' logs.

Dated Feb. 11, 1861.

352. C. Bonell, engineer, and W. M. Spiring, Wednesbury. A new or improved rotary engine.

354. W. Macnab, Greenock, engineer. Improvements in steam engines.

362. F. J. Bolton, 7 Bolton-row, Mayfair, captain in H.M.'s 12 Regiment of Foot. Improvements in rifle and gun stoppers and oil bottles.

Dated Feb. 12, 1862.

368. T. Coltman, Leicester, machinist. Improvements in sewing machines.

372. T. Spencer, Liverpool, engineer. Improvements in propellers for navigable vessels, and engines for actuating the same, parts of which are applicable to other purposes.

374. T. Horsley, jun., 10 Coney-street, York, gun maker. Improvements in breech-loading fire-arms.

Dated Feb. 13, 1862.

380. W. Hewitt, Birmingham, manufacturer. Improvements in rein holders.

382. W. H. Brown, Camberwell, paymaster, R.N. An improvement in yards, fore and aft booms, and gaffs.

386. J. F. and J. Lawton, Vale Mill, Micklehurst, near Stalybridge, Cheshire. Improvements in the manufacture of flannel for shirtings and other articles of apparel.

388. W. D. Allen, Laithfield House, Norfolk-road, Sheffield. Improvements in the manufacture of stamp heads and beds employed in crushing ores and other mineral substances.

390. E. E. Allen, 5 Parliament-street, engineer, and J. Stewart, Blackwall, engineer. Improvements in the construction of steam engines.

392. E. Green, button Manufacturer, Birmingham, and J. Newman, jeweller, Birmingham. Certain improvements in buttons for fastening and ornamenting articles of dress.

394. A. Jansen, Brussels, arquebusier. A new ball for fire-arms.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

378. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in the disinfection of animal excretions, and in the extraction therefrom of fertilizing elements for agricultural purposes. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2519. J. C. Ramsden. Healds or heddles for weaving.
2563. M Walker. Breech-loading rifles.
2564. J. Flinn. Watches.
2568. J. Gilbert. Endless railways.
2577. W. Biddell. Manufacture of shot.
2580. W. Smith. Increasing the illuminating power of gas. (A communication.)
2585. R. Smith and J. B. Rowcliffe. Winding yarn.
2586. C. De Groote. Corking vessels.
2591. W. Croome. Lamps.
2593. J. Crosthwaite and T. E. Arman. Construction of targets.
2594. J. Goucher. Thrashing machines.
2595. E. Peyton. Metal bedsteads.
2598. C. H. Holt. Steam engines and boilers.
2599. W. Streather. Wind engines.
2601. P. Robertson. Manufacture of cartridges. (A communication.)
2604. J. H. Johnson. Braiding machines. (A communication.)
2605. H. Macmeikan. Smelting. (A communication.)
2606. C. Cheyne and T. B. Moseley. Signalling on railways.
2609. R. Mushet. Manufacture of titanic pig metal or alloy of titanium and iron.
2614. J. Bourne and E. Kidd. Manufacture of metal tubes and cylinders.
2616. C. de Bergue. Permanent way.
2623. J. T. Smith. Collecting inflammable gases.
2633. J Toward. Armour plates.
2636. G. England. Planing machines.
2637. R. Mushet. Manufacture of a certain metallic alloy.
2639. H. May. Goloshes.
2643. G. H. Birkbeck. Separating or extracting silver from lead. (A Communication.)
2650. A. Morel. Combing filamentous materials.
2656. I. L. Pulvermacher. Production of galvanic and magneto-electric currents.
2657. W. B. Lord. Plug and socket.
2669. A. F. Campbell. Railways.
2678. H. Gilson. Slate-dressing machines.
2684. W. Robertson and J. M. Hetherington. Spinning and doubling.
2685. J. Sidebottom. Spinning and other machines.
2720. E. Leigh. Sailing ships and other vessels.
2732. J. A. Fanshawe and J. A. Jaques. Steam generators.
2784. G. T. Bousfield. Electroplating or depositing metals. (A communication.)
2786. H. D. Bradt. Pegging shoes. (A communication.)
2797. T. Schwartz. Air engines or air motors.
2822. W. E. Newton. Manufacturing and containing gaseous liquids. (A communication.)
2833. C. O. Crosby. Manufacturing pointed trimming.
2924. G. H. Polyblank. Protecting and preserving prints.
3009. T. Ellis. Permanent ways.
3150. E. Cajot. Manufacture of iron.
3182. W. Tate. Protecting ships and batteries.
23. H. Eschwege. Treating wood and other vegetable spirit.
81. T. Ramsay. Manufacture of coke.
306. W. Campion and H. Johnson. Making the welts of hose or other articles.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Feb. 21, 1862.

2115. J. Driver and J. Jessop.
2118. H. B. Coathupe.
2123. G. Nye.
2124. A. Lechene and C. Nathan.
2126. F. Tolhausen.
2130. H. Attwood.
2135. J. C. C. Azemar.
2140. A. Granger.
2148. S. Corbett.
2166. J. Bishop.
2174. C. Pemberton.
2184. W. Muller.
2244. G. H. Birkbeck.
2262. G. H. Birkbeck.

Sealed Feb. 25, 1862.

2125. J. L. Field.
2133. L. M. F. Patureau.
2139. J. M. Hart and R. Lavender.
2141. J. Ronald.
2142. B. Browne.
2146. J. Duncan.
2156. R. Shaw.
2161. H. W. Spencer.
2163. J. Harris.
2171. P. Taylor.
2172. T. M. Jones.
2177. J. Jones.
2187. J. Hall.
2188. J. Watson.
2189. E. Alcan.
2190. A. N. Saiers.
2192. W. Campion and H. Johnson.
2193. D. Ward.
2195. E. Suckow and E. Habel.
2203. P. E. Schneider.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

485. E. Lund.
490. S. Ridge.
491. W. Ashton.
497. G. Turnbull.
498. H. B. Barlow.
503. J. Crosland.
506. J. Dale.
512. C. W. Siemens.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

386. F. Prince.
389. P. Prince.
409. B. A. Murray.
431. A. T. Blakely.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending Feb. 22, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
1769	0	10	1782	0	3	1795	0	9	1808	0	3	1821	0	10	1834	0	7
1770	0	3	1783	0	3	1796	0	9	1809	0	3	1822	0	7	1835	0	3
1771	0	3	1784	0	7	1797	0	3	1810	0	6	1823	0	6	1836	0	3
1772	0	3	1785	0	3	1798	0	5	1811	0	9	1824	1	0	...		...
1773	0	3	1786	0	3	1799	0	3	1812	0	9	1825	0	10	...		...
1774	0	3	1787	0	3	1800	0	9	1813	0	7	1826	0	[illegible]	...		...
1775	0	3	1788	0	10	1801	0	3	1814	0	[illegible]	1827	0	3	...		...
1776	0	3	1789	0	9	1802	0	7	1815	0	[illegible]	1828	0	3	...		...
1777	0	10	1790	0	3	1803	0	3	1816	0	[illegible]	1829	0	6	...		...
1778	0	4	1791	0	3	1804	0	3	1817	0	[illegible]	1830	0	10	...		...
1779	0	5	1792	0	5	1805	0	10	1818	1	[illegible]	1831	0	3	...		...
1780	0	3	1793	0	3	1806	0	3	1819	0	3	1832	0	10	...		...
1781	0	3	1794	0	3	1807	1	4	1820	0	3	1833	0	7	...		...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Feb. 27, 1862.

		£	s.	d		£	s.	d	nett
IRON:									
Rails in Wales and North of England	pr. ton	6	0	0	to	0	0	0	
Welsh Bars, in Wales	„	6	5	0	„	6	7	6	„
Staf. Bars, at the Works	„	6	10	0	„	7	5	0	„
„ Hoops	„	7	10	0	„	8	0	0	„
„ Sheets, Singles	„	8	0	0	„	9	0	0	„
„ Nail Rods	„	6	15	0	„	8	10	0	„
„ Boiler Plates	„	8	0	0	„	8	10	0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	8	0	„	0	0	0	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	0	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	98	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	99	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9¼	„	0	0	0	2½
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	3½
„ Faggot	„	16	0	0	„	0	0	0	„
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	6	4	0	„	0	0	0	nett
„ Straits	„	5	17	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I.C.	„	1	1	6	„	1	4	0	„
LEAD:									
Pig, English	pr. ton	19	18	0	„	20	0	0	2½
„ Spanish	„	19	0	0	„	19	10	0	—
Common Sheet	„	21	10	0		22	0	0	—
Tea „ (Wimshurst's Patent) A special disct.	„	35	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	18	0		„	0	0	0	nett
For arrival	„	18	0		„	18	7	6	
ZINC:									
English Sheet	„	28	0	0	„	0	0	0	1½
QUICKSILVER	pr. btl.	7	0		„	0	0	0	3

JAMES LAURIE Metal Broker.
10 Old Jewry Chambers, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 7, 1862.

MEMORIAL TO THE LATE PRINCE CONSORT.

Now that Her Majesty's views in respect to the nature of the memorial which should be raised to her late illustrious Consort are quite understood, it may not be improper to offer suggestions as to points of design and detail in connection with that memorial. It is of the highest importance that no error or violation of the rules of art should be committed in the erection of the monumental structure in Hyde Park. It is true that the committee named for the purpose of carrying out and realising the objects of the subscribers to the memorial fund, is to a great extent a guarantee for the successful accomplishment of the work, yet we all are aware that under the best auspices undertakings of a like nature have too often resulted in failure. A monument to be worthy the Prince, whose virtues, talents, and industry are to be commemorated, and of the country which seeks to honour his memory, should be, indeed, free from fault—if so much may be said of anything which is the work of human hands.

A correspondent has given a pen and ink sketch of such a monumental edifice as he thinks would fulfil all the purposes and conditions of a work of this nature; and we have no hesitation in giving it the privilege of publicity. He proposes that the base should be an arabesque of nine sides, or a nonagon, with spiral columns rising from each angle, and on the tops of which should rest the Prince Consort's crown; within these columns there should be a statue of the Prince. The base, offering nine distinct angles, each of which to verge some feet from its upper or terminating part, in order that between them there should be medallions in which the life of the deceased for every five years should be portrayed in bas-relief; thus illustrating his birth, education, planning of the Exhibition of 1851, &c., &c.

Each projecting angle should rest on the back of a tortoise. At the upper part, and in front of each column, should be placed a figure of one of the Muses, to be cast in bronze. These should be so arranged, that those whose attributes the deceased most cultivated should be placed in front of his statue. Each projecting angle outside the medallions should be illustrative of the various crafts of the Muses. As regards materials, the plinth should be of polished red granite, whilst the medallions should be of white marble or bronze. The ground base should be about forty or fifty feet in diameter; the upper part, on which the columns would rest, about thirty or thirty-five feet. The spiral columns of white marble should have entwined around them flowers and fruit alternately arranged. Within the columns the statue should be placed on the summit of forty-two grey granite steps, polished. These would be circular, and, of course, rising pyramidically, and the figure should be shown placing one foot on the forty-third step. This last arrangement would be indicative of the age of the Prince Consort when the "icy hand "of death" was laid upon him. In order to relieve the steps of their monotonous appearance, there might be seated upon them marble figures emblematical of the four seasons. Spring should be on the right of the figure; Summer at the back; Autumn on the left, and Winter, denoting the period of the Prince's death, in front. The statue of H.R.H. should be of colossal size—at least twelve feet in height—and of bronze. The face of the figure should be turned towards the Horticultural Gardens and the Exhibition of 1862.

This disposition of the statue would place a column at its back, and leave six openings for front and profile views. Should any tameness of design be apparent between the back of the columns and the commencement of the steps, this space should be relieved by the addition of living cypress trees placed between them and the steps, but a little out of the line of the columns. These cypresses might be placed in appropriate bronze sarcophagi, and supplied by the Horticultural Gardens, the promoters of which would find it a labour of love and gratitude to keep them in health and vigour.

Surmounting the columns, the dome or roof might appropriately represent the Prince Consort's crown; the chaplet might be ornamented with representations of all kinds of implements and instruments of art, science, manufactures, and agriculture, interlaced with fruit, flowers, and appropriate foliage. At the side corners, or each angle of the terminating columns, there should hang the drooping willow. The upper part of the crown or roof should be of thick stained glass, dome-shaped. The rays of light of a subdued character passing through would fall more immediately on the head of the statue. The other parts of the crown should be covered with sheet copper gilt.

The total height of the memorial would, according to this arrangement, be from eighty to a hundred feet; and if the proportions were in all respects properly regarded, there cannot be a doubt that it would form a *tout ensemble* of ineffable, yet chaste and appropriate magnificence. It is possible that the cost of such a work would be from fifty thousand to sixty thousand pounds; and in carrying out its details, occupation might be found, not only for one, but a dozen sculptors and architects.

Without adopting entirely the views of the correspondent who has sketched out the above design, we put them before our readers and the public as worthy the consideration of both. They may also prove suggestive to those upon whom must more immediately fall the duty of deciding as to the form of memorial to be actually adopted.

In reference to the above, it may, moreover, be stated that it can only be in case the obelisk or monolith idea should be abandoned that our correspondent's plans can be entertained at all. We have our doubts about obtaining a granite block of such dimensions as would be requisite for a memorial worthy the Prince, and think it probable that some modification of that proposition may ensue. Hence, we have no hesitation in publishing the above.

THE WEAKNESS OF IRON SHIPS.

The weakness of iron ships is a subject upon which an immense amount of writing and talking has been expended during the last three or four years, not altogether without beneficial results. Mr. Fairbairn, moved by the appalling loss of the Royal Charter, in which an unexpected weakness of construction was displayed, gave a new impulse to the discussion about two years ago; and since that period the question has never been at rest for a single month. We took exception at that time to the spirit in which the discussion was taken up by Mr. Fairbairn, in his lecture at Liverpool, on account of the undue and unwise antagonism which was manifested towards the class of official ship surveyors—chiefly the surveyors of Lloyd's Register Office. We contended that it was an entire misapprehension to suppose that those gentlemen were either ignorant of the defects of iron ships, or unwilling to see them remedied. On the contrary, we maintained that of all persons they had the largest and most intimate acquaintance with those defects, and were extremely unlikely to view them with complacency. Mr. Fairbairn, however, had the courage and the public spirit to repeat his opinions in March, 1860, at the Institution of Naval Architects, in the presence of many eminent shipbuilders and of Lloyd's chief surveyors; and was backed up with no little energy by Mr. John Grantham, the author of the only treatise on iron-shipbuilding that, so far as we know, exists. The attack, however, broke down. Mr. Martin and Mr. Ritchie, the two most experienced shipbuilding officers in Lloyd's, effectually rebutted the charges brought against them, and were stoutly supported by Mr. Scott Russell. Last year a second paper was read by Mr. Grantham, but no discussion took place. At the United Service Institution, however, the subject was considered week after week for a considerable period; and the Scottish Shipbuilders' Association took it up soon after the first London meetings. Mr. Mansel (whose views on another question we considered recently) produced a paper or two involving theoretical suggestions to which but few are likely to attach importance; and Mr. Barber followed with a practical paper, in which the results of his experience, as shipwright surveyor to the Board of Trade, are stated.

This last production—Mr. Barber's paper—is one of the most valuable that has been put forward throughout these prolonged debates, and is deserving of much more prominent notice than it has yet met with. It is a great mistake to look so much as people are accustomed to for theoretical disquisitions, involving showy mathematical formulæ—disquisitions which are usually valued least by those who know their true character best—and to neglect the plain teachings of experience. We repeat, once more, that the men whose duty it is to survey iron ships, and note every defect which they disclose during sea service, are the men who can best explain to us their weaknesses, and tell us how to strengthen them. It is their daily business to do the very thing that we should most eagerly desire, if it were impracticable, viz., to examine attentively the effects which the sea, and the wind, and the steam engine, produce under varying circumstances, and in various kinds of vessels. If we knew nothing about iron ships, and wanted to find out all about them, the best thing possible would be to build a great number of them in different ways, put them upon actual service for certain periods, and then subject them all to close professional inspection. This system, coupled, of course, with intelligent reference to sound scientific principles throughout, would bid most fair to produce excellent ships. But the full advantage that could be derived from it is already possessed by the inspecting officers of the Board of Trade and of Lloyd's; and there is, therefore, no class of persons so wel able as they to correct, improve, and extend our knowledge of the principles of iron-shipbuilding. There is one danger to be guarded against, it is true: these practical men are not always wise enough to allow to theoretical science its due and legitimate influence. But this is an objection which does not apply to Mr. Barber, the author of the paper more particularly under consideration here. In this paper some only of the ordinary defects of iron ships are pointed out; but such as are mentioned are undeniable, [illegible] described.

Mr. Barber does [illegible] t iron st [illegible] r [illegible] r our c [illegible] e are exceptions, of course, to this; but such vessels are usually fit to perform their work well, without any necessity for additional strengthening. This may be accepted as true. It is in foreign-going vessels only that serious weakness is exhibited; and not in all these, but mainly in those whose lengths bear a great proportion to their breadths. The forms in which these vessels exhibit it are stated as follows: First, the butts of the outside plating are found in many cases to have opened, especially at the extremities of the vessel, and in the midship body, under the bottom, and at the sheer-strake. Secondly, the keel rivets are in many cases found to have worked slack Thirdly, in screw steamers, especially in large vessels, the after length of keel is found to have dropped below the straight line of the keel, causing its scarph, and the butts of the outside plating immediately in wake of it, to open. The causes assigned by Mr. Barber for these defects are well stated: The slack butts are the result of one or more of the following causes, viz. 1, imperfect fitting originally; 2, insufficient width of the butt straps; 3, inefficient shift of butts; and, 4, an insufficient number, and inefficient distribution of internal stringers, or girders, whereby the outside plating or shell is deprived of the necessary support.

The first of these causes is rapidly going out of existence in the yards of our best builders. Mr. Barber admits that these gentlemen are changing their opinions concerning the unimportance of fitting the butts of plates truly, and he is of opinion "that the practice which "obtains at some of the building yards of "foreign ports, of *planing* the butts, so as to "form a perfectly close joint, will before long "be universally adopted by the iron-ship "builders of this country." This, we are glad to say, is already done in some few of our English building yards. Messrs. Rennie are also applying the method throughout those immense floating docks which they are building at Greenwich. With regard to the second and third of the causes mentioned, Mr. Barber admits that experience is in favour of an increase in the width of the butt straps, but attaches much more importance to the introduction of a better "shift of butts,"—or, in other words, to the reduction of the number of the butts, by increasing the length of the plates. No one will question the efficiency of this change, but there are weighty considerations, of course, in favour of keeping the size of the plates down.

In reference to the slackness of keel rivets, which is often observed, Mr. Barber is somewhat inconsistent. He says, first, that it cannot be satisfactorily accounted for; and then goes on to explain that it is mostly observable in large vessels, where, from the thickness of the keel and starboard strakes, the rivets are necessarily of great length; and he adds, "when it is remembered that it is most "difficult, even with the greatest care, to make "a perfectly sound job of 'three-ply' rivets of "such a length, I think that the discovery that "a few of them have worked loose after a long "voyage need not occasion either surprise or "alarm." So we think, and thinking so, conclude that their slackness *can* be satisfactorily accounted for, in so far as it may be satisfactory to learn the cause of the mischief. There is no difficulty in accounting for the slackness of the bilge rivets in some of the Galway steamers, built in the north of England, if it be true that in some places the only connection that existed between the keel and the bottom was effected by means of *cement!* The defect servable at the after end of large screw mers is caused by the want of sufficient internal support for the propeller frame, and by the insufficient length of that portion of the frame which forms part of the keel.

The most important portion of the author's testimony concerning this subject consists in his assertion of the desirability of giving increased rigidity to the frame, and increased internal support to the outside plating, so as to render the hull, in a great measure, insensible to the strains to which the vessel is subject.

> "By increasing the number and width of the stringers; by the introduction of diagonal ties and hollow or box girders; by increasing the thickness of the strake above or below the gunwale; and by the improved methods of fitting the bulwarks, much good has been effected; and in all the cases which have come under my observation in which these alterations and additions have been made, the result has been most satisfactory, and has confirmed my opinion, that the strength and sufficiency of an iron ship depend, not so much upon the size of the different parts, as upon the connection of those parts with each other, and upon the amount of internal combination and support which is introduced."

This is a true view of the subject. All the loosening of rivets, and opening of butts, and snapping of pillars, and even breaking of beams, which are continually happening, result, not so much from local as from structural weakness. The bow and the stern, which are alternately lifted out of, and plunged into the sea in rough weather, are not combined sufficiently with the midship part of the ship, nor are they themselves supplied with that amount of "internal combination and support" which is requisite to resist the tendency to expansion and compression that is thus brought upon them. Hence it is that, with the whole structure bending and straining, rivets are forced to yield, butts are opened, and leaks are sprung.

As regards the after part of the ship, Mr. Barber thinks it desirable that attention should be directed to the devising of some means for affording greater support to the propeller frame so as to prevent the necessity for the subsequent introduction of those artificial modes of strengthening which have now to be often resorted to. He states that an improvement in the arrangement of the stern-tube and after compartment of screw steamers has already been made in some vessels built on the Clyde, and at the port of Hull, and is worthy of general adoption. It consists in causing the shaft to pass through *two* stuffing-boxes, instead of only one, before it enters the after hold, and is effected by securing the inner end of the stern-tube to a deep floor-plate (say two feet *within* the compartment) instead of securing it to the *front* of it, as is generally done. By this arrangement the shaft can be made to pass through a stuffing box at the end of the tube, and another on the front of the water-tight compartment, thereby affording security in the event of any accident happening either to the stern-tube, or to the after stuffing-box. Mr. Barber says:—"I could refer to vessels whose preservation, "after having met with an accident of the "nature described, is to be attributed to their "having been fitted with this improved arrangement, and also to others, fitted upon the old "system, which have had the after-holds filled, "and have been placed in great danger from "want of a second stuffing-box." The case of the new line-of-battle ship which was all but lost from a similar cause (in the Bosphorus, if we remember rightly), will be recollected by many of our readers.

The notoriously injurious method of attaching the water-tight bulkheads to the bottom of the ship usually adopted has not, of course, escaped Mr. Barber's notice. He seems not to be acquainted, however, with the improvements which Mr. Lungley and others have introduced, with the view of giving greater elasticity to the connection without unduly impairing the rigidity of the vessel. The question involved, however, is by no means easy of solution. The very strength which the bulkheads impart to the bottom is often injurious, and especially so in cases of collision, owing to the fact that points of greatest strength and of greatest weakness are thereby brought into adjacent positions. The author suggests that the amount of perforation in the vessel's side, which is now necessary for securing the two frames between which the bulkheads are fitted, might be lessened, if one frame only of T-iron, instead of angle-iron, were adopted; and the tendency of the vessel to "tear" at the bulkheads when left unsupported amidships or at the extremities, would be further lessened if, in the wake of each bulkhead, the vessel's side were to be doubled, or if a doubling plate (say four feet in length) were to be riveted on the upper or two upper strakes of plating. This method of doubling the plating has been applied very extensively, and with great advantage, by Messrs. Laird, of Birkenhead. All those new Galway ships which have been placed in their hands that they may be made sea-worthy have been treated in this way; and the experience already gained with Atlantic vessels previously strengthened in the same manner leaves no room for doubting the efficacy of the plan. It must be evident to all that the strength imparted by a second layer of plating, placed between two alternate outside plates, so that the edges of the former and of the latter come together, must be very great indeed. Messrs. Laird have long been in the habit of doubling their sea-going vessels in this way on the turn of the bilge and aloft likewise, and, as we say, with excellent results. We certainly think, with Mr. Barber, that the doubling of a portion of the plates in the wake of the bulkheads would be very advantageous in counteracting the weakness produced by the perforations for the bulkhead rivets, although we should not be content to rest satisfied with this improvement only. The fact is, it is a mistaken principle altogether to rivet a bulkhead to the bottom of the ship by means of a couple of ordinary angle irons, or by any merely equivalent means. What should be done is this:—From the vertical bulkhead, which provides a line of support vertically, brackets or girders should be led off horizontally, so as to distribute the strength over an extensive area of the side or bottom; this would prevent excessive strains being brought upon the bulkhead angle-irons, or upon that portion of the plating to which they are immediately riveted. Wherever water-tight bulkheads are employed, this distribution of their support should be provided for. In other words, the bulkhead should be well incorporated into the structure of the ship, and not be made to depend in giving and receiving support upon the mere rivets with which it is held to the thin plating.

In all that has now been said, no reference has been made either to the materials or the workmanship put into iron ships. Nor is there, indeed, much to be said on these. Their excellence where they are excellent, and their inferiority where they are inferior, depend, and always must depend, upon the honesty and ability of the builder. They do not at all result from the non-existence of professional knowledge. Among shipbuilders who are masters of their art, no doubt exists as to the quality of iron or of workmanship. There are, however, we grieve to say, shipbuilding firms—of no small pretensions, some of them—in which there is neither ability enough to discriminate between good iron and bad, or between good and bad workmanship, nor honesty enough to give the purchaser the benefit of what little knowledge they do possess. It would be vain to blink this painful fact, nay, it is worse than vain, for immense sums of money have already been sacrificed by important contracts falling somehow into the hands of such people. We dare not enlarge upon this part of the subject; but we are bound to state clearly and firmly that there are shipbuilders in respect of whose vessels the questions of material and workmanship need never be raised—providing payment for the best of each is duly made; and, on the other hand, there are shipbuilders who, even if a good design is furnished them to build from, will embody it in "boat-plates" put together abominably. "It must be admitted," as Mr. Barber said, "that the ignorance of some and "the carelessness of others who profess to be "iron-shipbuilders have, in a great measure, had "the effect of causing the brand of weakness to "be applied to iron ships generally." He has reason to believe, however—we regret to say that we have not—that the number of these is rapidly diminishing, and to hope that in a short time iron-shipbuilding will be carried on only by those who possess the knowledge requisite for the business, and who are determined that every portion of the work shall be faithfully and honestly performed.

The author concluded his valuable paper with some remarks upon the interference of the Legislature in shipbuilding matters. He pronounced a very strong and very sensible justification of the existing law, by which the Board of Trade is entrusted with the power, as he said, not to exercise oppression or vexatious interference, but to see that ships are provided with everything "sufficient for the service intended, and in good condition." And yet, he contended, complaints are made against the Board of Trade requirements, and made loudly too, without any consideration being given to the subject. And he employed an illustration —addressed very appropriately to a Glasgow audience. All who heard him would agree with him, he said, in believing that an alteration of that section of the Merchant Shipping Act which refers to bulkheads is now absolutely necessary, and that instead of requiring the vessel to be divided into three compartments, it should require such a sub-division that in the event of any one compartment being injured, the others should have sufficient buoyant power to sustain the vessel. They would also admit the necessity of an addition being made to the law to prevent the "overloading" which is so injuriously practised. "But if such alterations "were to be made," said he, "and I were to "put a circular to that effect into your hand, "would you not, directly you received it, exclaim, 'These new rules and regulations are "'becoming intolerable?'" We think it would be well for shipbuilders to consider this matter. No reasonable man doubts that relief can now be obtained from any oppressive legal interference with trades or manufactures, by simply proving, publicly and temperately, that it is oppressive. The only thing that we really need dread, in this respect, is that thoughtless complaining which some people indulge in from mere habit, and which serves to render us insensible to just and thoughtful complaints.

DIALYSIS, AND ITS APPLICATION TO THE MANUFACTURING ARTS.

Under the title of dialysis a most remarkable series of phenomena has been brought before the notice of the scientific world by Mr. Graham, the Master of the Mint. His discoveries on this subject are the result of a carefully conducted series of laborious experiments, extending over a long term of years. They offer to those who can afford the time necessary to trace them, step by step, as they have been published in the Transactions of the Royal Society, a most instructive example of the progressive growth of a series of inductive experiments, at first purely abstract, without any evident practical bearing, but eventually resulting, as all scientific truths must result, in extending man's dominion over natural objects and thus aiding the arts of life and civilisation. The steps of the progressive discoveries of Mr. Graham are hardly suited to our pages, or to the wants of the readers of a journal so essentially practical as the Mechanics' Magazine. We propose, therefore, to take the facts as they are now ascertained, and to show their practical bearing upon many of the manufacturing arts.

Dialysis depends upon the circumstances ascertained by Mr. Graham, that certain solutions possess the power of diffusing themselves through water with very great facility, and that others do not possess this property. In a very rough and coarse manner these facts might be illustrated by the following examples:—Suppose four deep glasses to be taken, and in one to be placed a few grains of common salt; in the second, an equal quantity of sugar; in the third, gum; and in the fourth, albumen, or dried white of egg. Let us now imagine the glasses to be each filled up with water, but with such precautions as should entirely prevent any agitation of the contents of the vessel. If the whole were left undisturbed, the solids, after a short time, would dissolve, and their solutions, being heavier than water, would remain at the bottom of the vessel in obedience to the law of gravity. But this law would soon be counteracted by another, namely, that of diffusion. The solution of salt, for example, would, in opposition to gravity, gradually rise and diffuse itself through the whole liquid. The solution of sugar would follow the same course, but with less than half the rapidity of the solution of salt. The gum, again, would be four times longer in mixing itself than the salt; while the albumen would require nearly twenty times the time. In fact, so different is the diffusive power of a solution of salt and one of albumen, that supposing the two mixed together, the salt would diffuse itself in the water, leaving the albumen in a pure state. On examination, it is found that those bodies are most diffusible which are crystalline, and that those are the least so which have an uncrystallizable character, and resemble gum, glue, and albumen, in this respect. As convenient names for these two classes of bodies, Mr. Graham has proposed the terms *crystalloids* and *colloids*.

Another fact of great importance with regard to the right understanding of the phenomena of diffusion is, that the solution of a diffusible substance or crystalloid will diffuse itself into, or through, a solution of a colloid body almost as rapidly as through pure water—but that the solution of another colloid body possesses no such power. It is upon this last fact that the practical application of dialysis and the construction of the dialyser depend. This instrument may be compared in form to a tambourine, in which the flat circle is formed of gutta-percha rings, and the membrane consists of parchment paper (a singularly tough imitation of animal parchment, obtained by the action of sulphuric acid on ordinary paper). If a liquid be poured into the dialyser it does not pass through by filtration, parchment paper being impervious to the mechanical passage of fluid. But if the dialyser be floated on pure water, and then a mixed solution of a colloid and a crystalloid substance be poured into it, the latter rapidly diffuses itself through the substance of the parchment paper into the water beneath, the colloid remaining behind. By this simple means the solution is separated into two parts, or *dialysed*.

Simple as this operation may appear, and as it really is, it gives us a power that we have never before possessed, namely, that of separating in the most easy and least expensive manner any mixture of different substances belonging to these two groups. Thus, a solution of sugar and gum is placed in the dialyser; the sugar passes through, the gum remains behind. A solution of white arsenic is mixed with a variety of substances, such as would constitute the contents of the human stomach; this is thrown into a dialyser, when the arsenic, being crystalloid, passes through into the clear water, and can be readily discovered by the usual tests, whilst the mixture of the various colloids, constituting the food, remains.

It is, however, in the power it affords of obtaining pure solutions of substances hitherto thought insoluble that the process offers the greatest advantages. Thus, by its aid have been obtained perfectly pure solutions of silica or flint, alumina or the basis of clay, of peroxide of iron, Prussian blue, oxide of tin, and a variety of substances of the same insoluble character.

Let us take flint, for example. It is usually regarded as one of the most insoluble bodies known; but by the aid of the dialyser it can be obtained dissolved in pure water, and may be used instead of tannin, or oak bark, for converting skins into leather. If it be fused with an excess of soda, it is converted into the well-known soluble or water glass. This, when acidified by hydrochloric acid, is decomposed, the acid unites with the soda to constitute common salt, whilst the silica remains dissolved. If this mixed solution be dialysed, the salt passes through, and a pure solution of silica in water remains behind. Thus, solutions containing three per cent. of silica may be formed as limpid as water, with a feebly acid reaction on test-paper, but insipid to the taste. In this latter character the solution resembles many colloid bodies which seem not to have sufficient diffusive power to pass through the membrane covering the tongue in order to reach the nerves of taste. After having been made some days, the solution of silica assumes the consistence of glycerine, and afterwards gelatinizes, the silica eventually separating in a solid insoluble form. The solution has a peculiar action upon gelatinous substances, such as skins, being absorbed by them, and converting them into a kind of leather, so that it is possible that flint may eventually become a cheap substitute for oak-bark in the process of tanning. On the addition of any carbonate, as chalk or limestone, the silica is caused to solidify in its substance in a hard flint-like form, and offers the possibility of converting soft and perishable limestone, by artificial means, into a hard and enduring siliceous stone.

Again, peroxide of iron may be dissolved in hydrochloric acid, thus constituting the perchloride of iron. This has the power of dissolving a large excess of the peroxide of iron. If this solution of the peroxide in the perchloride of iron be dialysed, the chloride passes through, leaving the pure oxide dissolved in water in a colloid state. This also can be rendered gelatinous in the same manner as silica.

Prussian blue, insoluble in water, is perfectly soluble with oxalic acid, and if this solution be dialysed, the oxalic acid
and a solution
This may be

little dilute sulphuric acid and by many other re-agents.

After having enumerated these examples, it is scarcely required to indicate the probable practical value of the process. It will certainly be employed to prepare solutions of many colloid dyeing materials, which will afterwards be caused to precipitate on the cloth, and so be capable of being used cheaply, and without a mordant. As a means of separating many mixtures, its use is obvious. It is probable that many valuable crystallized ingredients that now require for their preparation expensive and troublesome operations, may be separated from the crude mass of vegetable tissues with which they are associated naturally, by the inexpensive process of dialysis.

In fact, in all those arts which act by purifying, by refining, by separating different ingredients, and in those which, like dyeing, require the employment, in a soluble state, of substances which are usually insoluble, we cannot discern a limit to the practical application of this new operation.

CHARING CROSS WATER WORKS.

It will probably be in the recollection of our readers, that a few months since we ventured to offer to the Commissioners of Her Majesty's Board of Works some practical suggestions for the improvement of the fountain basins of Trafalgar Square. Those unsightly constructions, filled as they usually were, with stagnant water, had become not only a nuisance to the eye, but offensive to the nose, and we felt that the time had arrived when the public interest and the public health alike demanded their radical reformation. What the officials in question thought of our remedial proposition we know not, but up to the beginning of the last week they certainly had made no sign of being impressed with their value, or the necessity of making any change in regard to the basins. Now, however, we are happy to say that some symptoms of activity are being manifested in the neglected spot once designated "the "finest site in Europe."

A close hoarding has been erected during the past five days round the eastern basin, which has been drained dry and cleansed of the accumulated filth and slime of which it had become the receptacle. A pipe of larger bore, too, has been laid down between the well at the back of the National Gallery and the fountain. These steps are, we trust, but the preliminaries to the full realization of our own plans, and the effecting of such changes in the interior arrangement of the basins as shall make them more sightly to the eyes, and less noisome to the olfactory nerves of the numerous visitors to London during the Exhibition season than they otherwise will be. The main defect of the fountain basins, apart from the poverty of design conspicuous in them both, is unquestionably, as we before pointed out, their equality of depth from centre to outer circumference. They should be made more shallow in the centre than at the rim, in order that the water falling from the fountains might obtain something like an impetus towards the overflow outlets in the granite walls, and thus scour away as it were all impurities which attempt to form a lodgment. We trust that this important point will not be overlooked by those who have the work of renovation in hand. A few loads of bricks properly disposed and faced with portland cement, constitute all that is required to make the fountain basins—fed as they will be with abundance of water—wholesome and agreeable during the summer months instead of being, as hitherto, pestiferous and sant. Let the depth of the basins at the point where the falling streams impinge be two inches, and let that depth gradually increase to its maximum of two feet immediately inside the rims. Then if the joints of the latter be made tight there will, we are bold to assert, be little room left for grumbling.

THE ATLANTIC TELEGRAPH.

Several months ago we called attention to this most important enterprise as being in a condition, solely for want of the means of raising capital for its completion, which was anything but creditable to a country so familiar as ours with contention against physical difficulty; and we then indicated it was one of those peculiar works to which the moderate and well guarded aid of Government would be specially applicable. We are extremely glad to see that a move is now being made in this direction. The Government of the United States, stimulated no doubt by the forcible manner in which recent untoward events have brought before them the necessity for rapid communication with Europe, and by consciousness of the lapse that has been committed in remaining torpid so long, whilst the means of realising that communication in the most perfect manner has lain at the very door, have addressed a special despatch to their Minister here upon the subject. They express a warm desire to co-operate with the Government of this country in such financial or other arrangements as shall secure the means of bringing once again, and this time permanently, we trust, into action that wondrous agency which in 1858 startled the whole civilised world by its successful though short-lived operation.

The American Government do not stop even in their desire to co-operate with Her Majesty's Government in the establishment of this good work. Notwithstanding that the most practicable route will give possession to Great Britain of the entire control of the cable at both ends, they desire to enter into engagements whereby the Atlantic Telegraph and its communications shall be guaranteed from all violence and wilful damage, even in the untoward event of a war between the two countries.

Conduct so unselfish and so courteous can surely meet with but one response from the British Cabinet. We feel that Parliament, with scarcely a dissentient, would agree to the small amount of risk that has been named as sufficient to resuscitate this enterprise in conjunction with America. We believe we are right in stating that it has been intimated that a guarantee, under careful regulations, of about 2 per cent. from each Government on a capital of £700,000 would suffice upon which to raise the entire amount. Even this small guarantee we believe would never be called upon for a shilling. The blunders and mismanagement that have characterised several of these deep-sea cables which have proved failures have been so fully discussed in these columns that we need not further allude to them than to say that these evil days are now happily passed away, as we trust, for ever. That good and durable cables can be made, and laid, and worked in permanence, the Teulon-Algiers and Malta and Alexandria lines attest. Messrs. Glass, Elliot, & Co. have just published a list of the lines made and laid by them, which shows that every cable which that firm has ever made and laid is at this moment in active operation, except two inconsiderable lines recently broken by anchors, which can be repaired with the greatest facility.

The long time that has elapsed since the original cable gave way, has been turned to good account by the Atlantic Company in the investigation of all the circumstances attending deep-sea cables; members of the company, among whom were the chairman and late secretary, were chosen by the Government as members of the commission appointed by the Board of Trade to examine and report upon the whole subject; and these circumstances, in combination with the vast improvements effected by the Gutta-percha Company in the preparation of their insulating substance; the invention of other substances of a similar character, said to be even superior to that material when sufficient time shall have elapsed to test their durability in the sea; and the continually-increasing experience of contractors in laying cables, lead to a well-grounded belief that the next attempt to span the Atlantic ought to be and will be a perfect success.

It would be idle to dwell upon the enormous results that would arise to the benefit of commerce, of Government, and of civilisation generally, from the constant and regular flow of instantaneous communication between Europe and America. The connection of the Foreign, Colonial, and War-offices, and of the Admiralty, with their respective correspondents on the other side of the Atlantic would, without any other consideration, perfectly justify our Government in extending their warmest aid, consistent with prudence, to the carrying out of the Atlantic Telegraph Company's enterprise in the best manner, and at the earliest practicable period.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER II.

[*An error in the numbers of the figures to the diagrams of fastenings of armour plates in my last letter requires correction. The La Gloire fastening is referred to in the text as* Fig. 1, *and marked in the diagram* Fig. 3. *The Warrior fastening referred to as* Fig. 2, *bears* Fig. 1 *and the "protective plug" referred to as* Fig. 3, *is marked* Fig. 2. *The alterations can be made by your readers with the pen.*]

Before I resume the subject of the fastenings of armour plates, a few figures may be of use to show its financial importance. Taking the Warrior as a type, the cost of armour for a frigate is, in round numbers, £100,000; but this is below the average, for the ships ordered since last session are larger than the Warrior. Of this sum more than a half is the cost of the plates, of which the total weight is about 2,000 tons.

The expense of plates exceeding certain dimensions is regulated and greatly increased by the increase of weight. For plates of the Warrior size weighing three to four tons each, the price is £35 to £40 per ton. For half that size the price would be £25 to £30, and if the weight were reduced to one ton, or fifteen hundred-weight, there would be a further diminution of £8 or £10 a ton. Now, the system of fastening by through bolts, as applied to the Warrior, involves the necessity of using plates of large dimensions, and is, therefore, the cause of the high price paid for the iron. Other modes of fastening may, as before stated, admit of smaller plates being used, and if experiment should prove that an effective iron casing can be constructed with plates not exceeding one ton each, the saving in the price of iron alone would be £20 per ton, or £40,000 for each ship of the Warrior class. But this is not all—the expenses of fitting and fixing would be materially reduced by the greater facility with which smaller plates can be manipulated. It is then not too much to say that the change of system referred to, if found practicable, might be productive of a saving to the national exchequer of £50,000 for one ship, or one million for twenty iron-cased frigates. I do not affirm that any system of festening is or will be invented which will realise this favourable result to the extent I have supposed. I have seen too much of the disappointed expectations of inventors, whose plans (some of which found favour with the Iron Plate Committee or Admiralty) proved on trial to be failures, and I know that nothing but the inexorable logic of cannon balls will decide the merits of any plan. But what I contend for is that numerous experiments ought to be made at the public expense in a liberal and fair spirit. In the selection of plans for trial there should be no favour or prejudice. A sound discretion must be exercised, but this question is altogether so novel, and confessedly so little understood from want of experience, that the judgment of the most able engineers and mechanicians is at fault. Instances might be adduced of the most erroneous conceptions as to the principles of resistance to projectiles on the part of scientific men of the highest position and reputation; but any statement of that kind would only prove the difficulties which beset the question. In making these remarks, I wish to point out that the authorities should not be precipitate or over positive in refusing trials without ample investigation.

For making the choice of plans for trial, the government has adopted the right course in appointing the Special Committee on Iron, which is a body of professional and scientific men of known ability and of the most honourable character. Every plan should be submitted to them for examination No proposal should be entertained until it had been investigated and reported upon by this committee, and every kind of sub-official influence or prejudice should be over-ruled, if found to be in opposition to their opinion.

I have said enough to show that the expenditure of a large sum in target trials of well-considered systems of Iron armour for ships and batteries will be judicious economy, and I will now continue the description of

THE FASTENINGS OF ARMOUR PLATES.

The diagrams of fastenings which accompany this letter, exhibit several systems of which target trials have been made or proposed,

Fig. 6 and 7 represent the Thorneycroft plan of iron bars tongued and grooved longitudinally. About a year ago it was in high favour with the authorities. Many thousand pounds were spent in the construction and trial of targets on a large scale, including a small fort with an embrasure, and so eminently successful were the first experiments with smooth bore guns, to the assault of which these bars were impenetrable, that an arrangement with the patentee, who is a large ironmaster, was in contemplation for the supply to Government of this description of armour to the full extent of the capabilities of his works. It was considered, and justly so, an immense advantage to be able to carry out the armour plating principle with bars of iron weighing a few hundredweight each, which could be produced of the best quality at a low price. The object in view at that time, was the application of the system to land batteries. The success however of the earlier experiments, prompted the idea of applying it to ships, but the subsequent trials in the course of last summer with heavy guns at short ranges destroyed the Thorneycroft targets and demolished the tongueing and grooving theory.

It may not be apparent at first sight, why the Thorneycroft system is classed as a mode of fastening. The tongueing and grooving however was looked upon as an efficient fastening by imbedding the bars one into the other, and so forming a solid wall of iron which required only to be supported at the back by vertical iron bars or stringers two or three feet apart. Fig. 6 is a transverse vertical section of the bars and of one of the back supports, shewing the mode of fastening the former to the latter by means of a longitudinal dovetailed rib at the back of every third or fourth bar of the pile, and fitting into corresponding dovetailed slots in the stringers. Fig. 7 is a horizontal section of a bar and two vertical stringers two feet asunder. The dimensions adopted in the trial target here represented, were for the bars 12 feet in length by 4 inches in width and 8 inches in thickness from the face to the back, for the stringers 10 inches by 4½ inches, and for the dovetails 1½ inch in depth by 3½ and 5 inches. The semicircle on the face of the third and fourth bars from the top in Fig. 6 figures the impact of a heavy shot planted at the joint of those two bars. The effect produced by the shock of three or four discharges of Armstrong and 68 pounder guns is partially represented by the cracks shown on the drawing and by the dotted outline of a fractured stringer. The momentum of the projectile was transmitted to the dovetailed bar, which tore away the longitudinal tongues of the bars above and below, projected the dovetail against the stringer, and burst it asunder. Evidently this mode of applying a dovetailed fastening is a mistake. It is placed in the wrong direction. Instead of projecting from the back of the bar and being let into the stringer which is thereby weakened, the dovetail should project from the back support and the slot to receive it should be in the longitudinal rib. Although the Thorneycroft bar broke down in the final experiments it is not without its merit. Its failure is to be attributed to defective fastening and total absence of backing, which caused vibration and oscillation in the bars struck to such an extent that in another target 10 inch iron bars were broken asunder as if they had been slender rods. The Thorneycroft system was entirely relinquished, and the theory of enormous masses of iron for armour plates was adopted and acted upon without further investigation. From narrow bars weighing a few cwts., to 15 feet plates weighing 4 tons, the change of opinion in the official mind was extreme and decisive, and yet it was founded on inconclusive trials.

Fig. 8 is a representation of Mr. Fairbairn's plan of mortice joints, connecting the buts of the plates longitudinally. It may be regarded as a supplementary fastening with a two-fold object, namely, to cause the plates to overlap and hold each other, and to counteract their tendency to buckle at the ends. But this arrangement on trial proved to be a source of damage; the mortice joint was crushed by the impact of shot and became the origin of long and deep cracks in the plate. This result seems to have proceeded from the fact that no means was or probably could be employed to draw the mortices at the buts into close contact; hence there being a slight separation of the surfaces, the momentum of the projectile would be transmitted to and easily fracture the parts of the plate weakened by being reduced to less than half its thickness. The screw bolt fastening tapped into the back of the plate and the manner in which at the trials it broke off at the first thread was described in my last letter, (Fig. 5.)

FIG. 8.

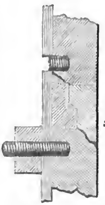


FIG 6.

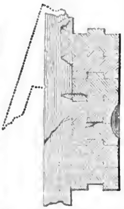


FIG. 11.

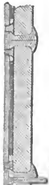


FIG. 10.

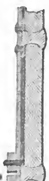


FIG. 9.

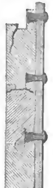


FIG. 7.

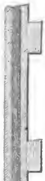


Fig. 9 is a vertical section of a plan proposed by Mr. Lancaster, and considered by the Admiralty so promising, that he was authorised to construct a target at the public expense on a large scale, exceeding that of the Warrior target, for £2,000. The attractive feature was the combination of the bar or narrow armour plate with the tongue and groove joint longitudinally, and an ingenious compact mode of securing the plates at the back, by bolts rivetted to the iron skin without intervening wood backing, and without exposing the rivets to the impact of shot. The plates were to be eight to ten feet long, eight inches in width, and five inches in thickness. In the working model and drawings the plan looked well, and appeared to offer no difficulties of construction. Sanguine expectations of its success were entertained in official quarters, but they were not endorsed it is understood by the Iron Plate Committee. The frame of this target, forming the section of an iron frigate's broadside, and a well constructed piece of work thirty feet in length, and ten feet in height, from the yard of Messrs Mare and Co., was set up complete at Shoeburyness, when suddenly the plan was suspended, and the frame has since been placed at the disposal of Mr. Scott Russell to be covered with armour plates on a plan which will be presently described. Obstacles presented themselves in the manufacture of the Lancaster plates. These no doubt would have been overcome, but in the meantime several target trials proved conclusively that tongueing and grooving is a source of destruction. The probable effect of projectiles on the plates is shewn by cracks figured on the diagram. The further prosecution of the plan is said to be abandoned.

Figs. 10 and 11 are longitudinal sections of two systems which demand careful consideration. The first the invention of Mr. Plum, of the Blaenavon Iron Works was patented the 26th January, 1860, and a similar invention was patented by Mr. Lancaster, the 25th July following. The second, the invention of Mr. Scott Russell, was patented the 28th December, 1860. Things which are similar often differ from each other, and things which appear to differ are sometimes the same. The latter position is singularly exemplified by the Plum and Scott Russell plans, which are here placed in juxtaposition, that they may be readily compared with each other. The former is plainly described as a "mode of fixing armour plates to ships by means of dovetailed or T head ribs fitted to the edges of the plates," and the latter as a mode of effecting the same object, "by hammering or bending the heads of T or angle iron over the edges of protecting plates." Stripped of its peculiar mode of forming the dovetailed or T head by hammering or bending the ends of T or angle irons over the edges of the plates, *after* the latter are in their places, Mr. Scott Russell's system of fastening is in principle and in its results precisely the same as Mr. Plum's. This will be seen by an examination of the diagrams. In both cases the plates when the work is finished are held at their edges by dovetailed ribs between the plates. The only difference is that in one case
ribs are manufact ar
before they are
other case the
out of two angl

projecting heads which are hammered down after they are fixed. It requires little reflection to perceive that Mr. Plum's method must be more sound in its workmanship than the other. Dovetailed ribs rolled in one piece can be manufactured more solid, tough, and reliable, as a means of resisting the concussion of shot than ribs of which the heads are hammered over the edges of the plates, for the latter work may be imperfectly executed, and cannot be thoroughly inspected, or if defective replaced. The only difference in the application of the two plans as described, is that Mr. Plum proposes to fasten the flanges of his ribs with bolts and nuts, and Mr. Russell with rivets. Bolts are probably more secure; rivets, judging from many experiments, are a treacherous fastening, not to be relied upon to resist the shock of projectiles if any amount of vibration is produced. But if rivets are found to be preferable or avilable, there is no reason why Mr. Plum should not apply them to the flanges of his ribs.

As to expense of fitting, it must be less in making use of ribs previously rolled and ready to be applied as the work proceeds, than in hammering down the heads after the plates are in their places. The whole of this work indeed may be regarded as an additional and unnecessary expense.

The circumstance which gives importance to this mode of fastening, is that the Admiralty has authorised Mr. Scott Russell, at the public expense, to cover the large Lancaster target frame of 300 square feet refered to under Fig. 9, with armour plates on his plan, and the work is in progress at Shoeburyness, where the trial will soon come off. I am not aware whether Mr. Plum has obtained a similar privilege, but it certainly would be desirable that his method should be also tried, for it seems that the same result as that contemplated by Mr. Scott Russell, might be obtained by Mr. Plum's plan more effectually and more economically. No amount of hammering at the edges, however carefully executed, will fix the plates firmly to their bearings, and prevent vibration, or even oscillation, which is a greater evil.

A question may arise, whether Mr. Scott Russell's expedient for forming the dove-tails to the ribs, by hammering them over the edges of the plates, is not an imitation of Mr. Plum's invention, which is described as "a dove-tailed rib, fitted to the edges of the plates." Mr. Russell's complex mode of fitting, when accomplished, produces exactly the same result, and it is not apparent what advantage he proposes to obtain by his method, which is so much more costly and inconvenient, and less efficient than Mr. Plum's.

The success of any kind of frame fastening to the edges of the plates, however it may be carried out, is problematical. The fastening is fully exposed to the impact of shot. The dove-tailed head, which holds the edges of the plates is under much the same conditions as the tongue and groove system, which has proved to be a decided failure. The outer edges of the dove-tail, nowhere more than two to three inches thick and tapering to nothing, on which the holding of the plate depends, are liable to be ripped up and stripped off the plate. The rivets or bolts which fasten the ribs, and are liable to receive the full shock of every concussion, may be broken off. This edge fastening which holds the plate like a slate in its frame offers no security against vibration, of which Mr. Scott Russell seems to apprehend the consequences, as he proposes to hold the plate firmly by means of a few through bolts, thus adopting one defective plan to remedy another.

I trust the details of the various plans described will not be tedious to your readers. Some of them might be omitted, were it not that in this complicated question it is quite as necessary to show what to avoid as what to choose.

In my next letter I will describe one or two other methods of fastening, and then enter upon the question of the backing of armour plates.

A Civilian.

TRIAL OF THE IRON PLATE COMMITTEE'S TARGET AT SHOEBURYNESS.

On Tuesday last an experiment, intended to determine an important principle in armour-plating ships of war, came off at Shoeburyness, in presence of the Lords of the Admiralty, the Special Committee on iron, and a large body of naval and military officers; several eminent engineers, shipbuilders, iron manufacturers, and gentlemen who have submitted plans to the Admiralty, were present.

It will be in the recollection of our readers that in October last the trial of the Warrior target took place. The principal feature in that target, which is a section of the Warrior frigate, 20 feet in length by 10 feet in height, is a teak backing, 18 inches in thickness between the armour plates and skin of the ship. The target which was experimented upon on Tuesday is of the same dimensions as the Warrior section, and constructed on the same plan, with the exception that there is no wood backing to the armour plates, which are in contact with the skin plates, and the skin and the ribs, which represent the frame of the ship, are strengthened with an additional weight of iron nearly equal to the weight of the 18 inches of teak. In both cases the armour plates are 4½ inches in thickness, and 3 feet 6 inches in width, two of these—the top and bottom plates—20 feet in length, and two between the former, 8 feet in length, leaving a porthole in the centre. The fastenings of both targets are similar, namely, through bolts with conical heads, those of the Warrior being 1½ inches, and those of its rival 2 inches in diameter. The weight of the former is 33 tons, and of the latter 31½ tons.

The target of which we are about to describe the trial, was constructed by Messrs. Fairbairn and Co., of Manchester, on a plan proposed by the Special Committee on Iron, of which Mr. Fairbairn is a member, by order of the Lords Commissioners of the Admiralty, and the experiment was intended to determine whether wood backing is necessary to protect the bolts and rivets from being destroyed by vibration.

The result arrived at, if not satisfactory for the committee's target, determines conclusively that armour plates attached to the skin of an iron ship without any backing, on Mr. Fairbairn's plan, would afford no protection whatever to the ship, for the simple reason that a moderate amount of firing from heavy guns would detach the plates from the ship by destroying the fastenings. In our last number, in describing the character and effect of through bolts as a fastening to armour plates, it was stated that "the effect of vibration arising from the absence of wood backing would be to break off the bolts at the thread of the screw inside the skin." That effect precisely, as will be seen, was produced.

The practice at 200 yards' range commenced with the first round, which consisted of five shells filled with sand, fired one by one; three, weighing 104 lbs., were fired, from 100 pounder Armstrong guns; two, weighing 49 lbs., from 68-pounders, smooth bore. One 104 lbs. and two 49 lb. shells struck the middle plate on the left hand side of the porthole about the centre, covered each other, leaving the mark of each shell, and made an indentation in the plate 18 by 16 inches, and ⅝ths in depth. The other two 104-pounders made slight indentations—one at the top and the other at the bottom of the same plate. The effect of this round was most destructive to the fastenings. Eight bolts were broken off clean as if cut with a chisel, and all precisely in the same way at the thread of the screw close to the skin and level with the inside of the nut. Three bolts were started outside the plate, the heads projecting 1 to 2 inches. One of the rib plates behind the point of impact and its two angle irons were cracked through, and three or four rivets flew off. The armour plate was driven inwards ¾ of an inch in the middle, and curled up from its bearing about ½ an inch at the outer butt. The second round, consisting of the same number and description of projectiles, but which were live shells, was fired at the same plate. Two struck close to the porthole, and two at the other extremity of the plate. The former, which did the most damage, made an indentation 11 by 9 inches, and more than an inch in depth close to the port. The concussion fractured the iron timber behind completely in two, and bulged the skin plate inwards one to two inches. Four more bolts, with their nuts, and several rivets were broken off. The third round, which was fired at the middle plate on the other side of the porthole, consisted of solid shot, one of 140 lbs., with a charge of 20 lbs., and three of 110 lbs., charge, 14 lbs., from Armstrong guns, and one 68-pounder, charge, 16 lbs. The 110-pounder and 68-pounder shot were planted at the lower part of the plate close to each other, making an indentation in the iron of 12 inches by 10 inches, and 2 inches in depth. The impact of one of these projectiles on the head of a bolt, drove it through the plate, and caused several cracks, without, however, any serious damage, owing to the excellent quality of the iron, which was supplied from the Atlas Works, of Messrs. John Brown and Co., of Sheffield. Two 110-pounders and the 140-pounder struck the joint of the same plate, and of the plate above it, fracturing both plates at their edges over a space of 20 inches by 17 inches. The last of these shots made a breech between the two plates crushed through one of the ribs, and carried away large fragments of the skin plates, through which it made an aperture two to three feet in diameter. The middle plate was driven in bodily 2 inches at the centre, and started away from the skin more than inch at the butts. Five bolts and several rivets were broken off.

Three more rounds, two of them salvos of 3 guns and 6 guns remained to be fired, according to the programme, in order to submit this target to the same ordeal the Warrior target had undergone; but the pounding it had already suffered had put the former "*hors de combat.*" The fastenings were destroyed, nothing remained to hold the plates on, so that the order was given to cease firing. The question which was the object of the experiment was solved; the destructive effects of vibration on iron armour fitted to the skin of an iron ship, without backing, were conclusively demonstrated.

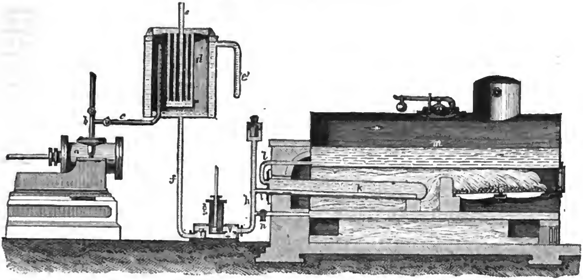
The sudden result and complete failure of this trial, as compared with that of the Warrior section, is the more remarkable, because the shell filled with sand which produced no sensible effects in the latter case, completely demolished the through-bolt fastenings. The small amount of damage to the rivets, considering the destructive effects on the screw bolts is worthy of notice, not more than ten or twelve rivets, so far as could be seen, being damaged, but no reliable inference can be drawn from this fact, as the trial target was not subjected to the tremendous assault of a salvo, which, in previous experiments was so damaging to rivet fastenings.

This experiment has created intense interest in the shipbuilding and engineering world, as well as in official quarters. The whole question as to an effective system of armour plating is thrown open, and it is felt on all sides that nothing but a series of experiments on a suitable scale can determine which is the best method.

STEAM REGENERATORS.

In the drawing annexed, *a*, is the cylinder of a horizontal high-pressure engine; *b*, a pipe for conveying the steam, which ordinarily escapes after acting on the piston, through the pipe *c* into the receiver or surface condenser *d*; that portion of the pipe (*c*,) contained within the chamber or vessel (*d*,) is perforated with numerous apertures or openings to admit of the steam separating and passing therethrough, coming in contact with the tubes or spaces contained therein, whereby it is condensed (forming almost a perfect vacuum and increasing the effective force of the steam on the piston), and falls into the lower part of the receiver. This vessel or receiver is kept at a low

STEAM REGENERATORS.



temperature by means of cold water fed from the pipe *e* passing therethrough and circulating up the tubes into the upper receptacle where it flows into the exterior casing, from thence through the exit pipe *e*.

By means of the pump *g*, the condensed steam is alternately drawn and forced from the vessel *d* through the pipes *f*, *h*, and *i*, into the regenerator *k*, placed in the flue where it is subjected to the heat arising from the products of combustion, and thence by a second pipe *l*, into the boiler *m*, which it reaches completely regenerated and ready to act again on the piston with all its original force; a cock *n* is provided for the purpose of shutting the feed off from the lower portion of the boiler when necessary, and may be used as a sluice cock.

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

By DR. F. CRACE CALVERT, F.R.S.

(*Concluded from page* 145.)

Madder Styles.—Although there has been no marked change in this important branch of calico printing, still there are one or two departments in which considerable improvements have been effected, to which I desire to draw your attention, and to enable you better to understand the nature of these improvements, I shall describe them in the order in which they come into play in the production of this class of goods. The first is the improvements in patterns, arising out of the before-mentioned advances in the art of engraving. Secondly, a saving in the quantity of mordant used; for the fact which I have already stated with reference to commercial alizarine, viz, that weaker mordants are required, has been proved by Mr. Pincoff to hold good with all the other preparations of madder, the strength of the mordant required to obtain the same intensity of shade being less, in proportion as the colouring matter is purer. It is also advisable that I should here state that the mordants generally used for madder styles, are the pyroligaites, or acetates of iron and alumina, which under the influence of "ageing," to be described presently, are so decomposed or modified as to leave on the cloth, either an insoluble oxide or subsalt, which becomes the intermediate agent for fixing on the fabric the colouring matter called alizarine, iron giving from a dark purple to a light lilac, alumina from a dark red to a pink, and a mixture of these two mordants a variety of chocolate tints Thirdly, the most important improvement which has taken place in this branch of printing, viz., a great saving of time and labour in the fixing of mordants by ageing, was first practically carried out by Mr. Walter Crum, the eminent scientific calico printer. Dr. Schunck says that, "On the proper ageing of printed goods depends, in a great measure, the success of many styles; should a room be too hot or too dry, imperfect fixation of the colour ensues, and meagre and uneven tints are obtained in the subsequent operations. To give a further idea of the importance of this step in calico-printing, I may state that 'ageing-rooms' as they are called, are in several print works of enormous dimensions, and are generally separate buildings. Those of Messrs. Edmund Potter and Co., and Messrs. Thos. Hoyle and Co., may be particularised as forming quite a feature in their works." The process of "ageing" in calico printing is that by which a mordant, after being applied to a cotton fabric, is placed in circumstances favourable to its being completely incorporated with, and fixed in the fibre. It has generally been found desirable that calico printed with a mordant, should, before dyeing, be exposed to the atmosphere for some time in the ageing-room in single folds, which, generally speaking, requires several days, the object being, as before stated, to liberate the acetic acid from the acetates of iron or sulpho-acetate of alumina, and to oxydise the oxide of iron. It was for many years believed that oxygen was the only necessary agent, and although some printers had observed that moisture facilitated the process, this fact was not generally known until Mr. John Thom, of Manchester, claimed the introduction of moisture as an important agent in the phenomena of ageing, in a patent which he took out in 1849. The first printer, however, who, as far as I am aware, practically applied this principle, was Mr. Walter Crum, F.R.S. But I cannot better show you the great saving effected by the judicious employment of steam in this process, than by giving you, in Mr. Crum's own words, the particulars of the plan adopted at Thornliebank print-works:—

"A building is employed 48 feet long inside and 40 feet high, with a mid-wall from bottom to top running lengthwise, so as to form two apartments, each 11 feet wide. The manner in which they are fitted up will be understood by reference to the drawing.

"In one of these apartments the goods first receive the moisture they require. Besides the ground floor, it has two open sparred floors, 26 feet apart, upon each of which is fixed a row of tin rollers, all long enough to contain two pieces of cloth at their breadth. The rollers, being threaded, are set in motion by a small steam-engine, and the goods to be aged, which are at first placed in the ground floor, are drawn into the chamber above, where they are made to pass over and under each roller, issuing at last at the opposite end (on the right-hand side of the drawing), where they are folded into bundles on one (at a time) of the three stages which are placed there. These stages are partially separated from the rest of the chamber by woollen cloths.

"While the goods are traversing these rollers, they are exposed to heat and moisture, furnished to them by steam, which is made to issue gently from three rows of trumpet-mouth openings. The temperature is raised from 80 to 100 degrees, or more of Fahrenheit—a wet-bulb thermometer indicating at the same time 76 to 96 degrees, or always four degrees less than the dry-bulb thermometer. In this arrangement 50 pieces of 25 yards are exposed at one time, and as each piece is a quarter of an hour under the influence of the steam, 200 pieces pass through in an hour. Although workpeople need scarcely ever enter the warmest part of the chamber, a ventilator in the roof is opened when there is any considerable evolution of acetic acid.

"The mordant, as already explained, does not become fully 'aged' by this process alone, although as much so as if it had hung a whole day in cold air. It has received, however, the requisite amount of moisture (about 7 per cent. of the weight of the printed piece), and is thereby enabled, if an iron mordant, to take oxygen from the air, and to become changed (with time) into the sesquiacetate and sesquihydrate of iron. In order to be sufficiently aged, it must be left one or two, or even three days, in an atmosphere still, warm, and moist.

"It had fortunately been ascertained long before, at Thornliebank, that exposure in single folds after moistening was not necessary. Mr Graham's experiments on the diffusion of gases through small apertures had served to suggest that for the absorption of the small quantity of oxygen required, the goods might as well be wrapped up and laid in heaps. Accordingly, in the operation in question, the moistened goods are carried in bundles into the building on the opposite side of the mid-wall already mentioned, and deposited there upon the sparred floors, which are placed there at heights corresponding with the stages in the first apartment on which the goods are folded down. Upon these floors seven or eight thousand pieces may be laid at a time, and as each piece is 25 yards long, 100 miles is therefore the quantity that can be stored at once. It is necessary, of course, that an elevated temperature, and a corresponding degree of moisture, be preserved in the storing apartments day and night, and 80° Fahr. is sufficient, with the wet bulb at 76°. To effect that object a large iron pipe is placed along the ground-floor underneath, and moderately heated by steam, while a row of small jets in the same position are made to project steam directly into the air of the apartment. The whole building is defended from external cold, and consequently from condensation of steam, by a warmed entrance room, and by double windows, and double roof. Small steam pipes are also placed at other points where they seem to be required; and the apartment with rollers is specially heated, when not in use, by a couple of steam pipes, which are placed under the ceiling of the ground floor.

"The process of ageing, as thus detailed, was in operation at Thornliebank, in the autumn of 1856. About a year afterwards it began to be adopted by other printers, and now it is already in use at, at least, sixteen different printing establishments in Scotland and in Lancashire."

Fourthly, *Dung Substitutes.*—During the last few years the various dung substitutes, such as the double phosphate of soda and lime, the arsenites and arseniates of soda, and the silicates of soda have completely taken the place of cow dung in the process of dunging, that is to say, a process which consists in passing the mordanted and aged cloth into weak and hot solutions of the above-named substances, with the view of fixing thoroughly the mordant in the cloth, and removing any excess that may have been used, without allowing it to fix itself on the white, or unmordanted parts. By the introduction of these dung substitutes, and improved dunging vats, a great saving of time, labour, and expense has been effected. Thousands of pieces are now done in the same vat, where formerly as many hundreds only could be so heated.

Fifthly, *Washing Machines.*—As madder goods have to be thoroughly washed, not only after this operation, but after also dyeing, several improved machines have been introduced in the trade. I shall only here mention those of Messrs. Mather and Platt, Mr. Furnival, Mr. D. Crawford, the last of which is much used for steam work and loose colours, and especially that of Mr. Thomas Whittaker, which I have heard highly praised by madder and garancine printers, and a model of which I have the pleasure to lay before you, through the kindness of Messrs. Christopher, Whittaker, and Co. To give you an idea of the vast capabilities of some of those machines, I will cite the following fact mentioned by Messrs. Whittaker:—"Our machine will wash 6,000 yards for all kinds of dyeing purposes, and 12,000 yards for all bleaching purposes, per hour (which only requires the attention of a person of 12 or 14 years of age)."

Sixthly. After the madder goods have undergone the above improved process, they are ready for the dyebeck, where the mordants assume the colours for which they are adapted. Here, also, a slight improvement has been effected, the advantage of which is a saving of time; as it now requires for saturating the mordants with alizarine only 1½ hours for garancine and 2 hours for madder. After leaving the dyebecks the pieces are thoroughly washed in the improved washing machines, but as the white parts (or those not mordanted) are still soiled and the colours dim, it is necessary to pass the pieces for half an hour into a rather strong soap solution heated to 180°, when the loose dye is not only removed from the white parts, but also from the parts on which colour has been fixed. To finally brighten the colours and completely clean the white portions, the pieces are passed into a weak solution of what is called "chemic," or an alkaline hypochlorite of soda, with a little sulphate of zinc, until the desired effect is obtained, but latterly this process has been improved by passing the goods rapidly into chemic and then through a steam-chest. As the pieces have not yet, however, a commercial appearance, they further undergo what is called finishing, that is, the pieces are passed through a solution of sour flour (flour which has been fermented for several weeks), starch, farina, &c., and then between rollers, dried, and lastly through calenders, the object of which is to fill up the interstices of the fabrics and to [give] them a glossy appearance. Much improvement has also taken place in this department of printing, by the introduction of new machinery, especially in the methods of adapting the finish to the various markets of the world. I wish to take the opportunity of impressing upon printers the importance of dispensing as much as possible with the use of sour flour, and confining themselves to that of starch or farina, with the addition of about 1 ounce of sulphate of zinc per piece, for the purpose of diminishing the risk of mildew and other stains, to which a low class of printed goods are liable, during their transit in tropical climates, and especially those dyed with common garancine, bark, sumach, and peachwood.

In concluding my remarks upon madder, I wish to draw your attention to these beautiful examples of madder styles, for which I am indebted to Messrs. Symonds, Cunliffe, and Co., and of garancine styles to Messrs. Wood and Wright.

Indigo—Most of the styles obtained with this valuable dye-stuff are due to the mixture of printing and dyeing, and only a few improvements have been effected herein, to my knowledge, during the last ten years.

First, the usual method of dyeing cotton, plain or self blue, is to fill with water large stone vats, and dissolving in them two parts of sulphate of protoxide of iron, adding one part of finely ground indigo, and then three parts of hydrate of lime. After having well stirred the whole for several hours, pieces of calico which have been hooked on a frame and dipped in lime water, are then plunged for 15 minutes into the vat, when the blue indigo which has been converted into white indigo by the protoxide of iron, and rendered soluble by the excess of lime, fixes itself on the fibre, and, on the exposure of the latter to the atmosphere, reabsorbs oxygen and becomes blue. When white patterns are required, the pieces are printed before dying with what is called a "reserve," that is, a composition which prevents the colour from fixing itself on the fibre; the chief ingredient for that purpose is sulphate of copper, which acts by prematurely oxydising the indigo, and thus preventing its fixation. In both these cases the pieces are passed through a weak sulphuric acid bath to perfectly fix the indigo, and formerly the copper thereby liberated from the fabrics was completely lost. Mr. Joseph Leese has recently devised a method of saving this valuable metal. To effect this, the diluted solution of sulphate of copper is made to filter through vessels containing wrought-iron turnings, the acid thus dissolving the iron, which may be used as sulphate of protoxide of iron for future operations, whilst the copper deposited on the excess of iron employed may be used, if thought fit, to manufacture again sulphate of copper. To give an idea of the importance of small savings, I may state that this ingenious, but apparently trifling improvement, saved at least £3,000 a-year to one firm.

Secondly. A few years ago I was able also to effect an economy in this branch of calico printing, which consisted in extracting from the cold indigo vats, which were considered by the printer to be exhausted, a considerable percentage of the indigo originally employed. Having observed that a green insoluble flocculent matter, which remained in the vats, and which was considered by chemists and printers to be simply oxide of iron, was in reality a compound of indigo and iron, I devised the following simple means of extracting the indigo therefrom:—The green pulp alluded to was conveyed from the several exhausted indigo vats into a general receptacle, and there mixed, first with a small quantity of hydrochloric acid, so as to remove the excess of lime, allowing the green pulp to settle, and running off the liquor. The so purified green pulp was then treated with strong hydrochloric acid, when chloride of iron was produced, and the indigo liberated, which required only to be washed to become again fit for use.

Thirdly. Although the printing of indigo offers great difficulty, still several printers have recourse to it from time to time, with greater or less success. The usual method of printing indigo, consisted in mixing finely-powdered indigo with orpiment, or protochloride of tin, with a caustic alkali, and this process was further facilitated by printing the pieces in an atmosphere of coal gas, as devised by Mr. Bennett Woodcroft, the present learned officer of the Great Seal Patent Office, and carried out by Messrs. T. Hoyle and Sons, of Manchester. But of Late years Mr. Joseph Leese, of Messrs. Kershaw, Leese and Co., has succeeded in applying the following method, first devised by Mr. Fritzsche. The Indigo is finely ground, and reduced to an impalpable powder, and then mixed with glucose, lime, and caustic soda, in such proportions as are needed to produce the shade of colour required. These materials are all mixed cold, and after the cloth is printed with the mixture, it is passed through a steam chest, in which it is exposed for the space of from 30 to 60 seconds. In this short period the indigo is completely reduced and rendered soluble, when it enters into the fibre, and on emerging from the steam chest it becomes oxydised and fixed by exposure to the atmosphere, or the pieces may be immersed in a solution of an oxydising agent, such as dilute sulphate of copper, after which they only require to be washed, dried, and finished.

I am not aware of any marked improvement in the style of printing called "spirit colours," but in that of "steam colours" considerable advance has been made since 1851, rather, however, in a mechanical and artistic, than in a chemical point of view. Thus, it was owing to certain mechanical improvements that Mr. Robert Kay, calico printer, of Manchester, and his workmen, had the honour of obtaining the gold medal at the Paris Exhibition of 1855. The beautiful furniture patterns which he exhibited there were the result, not only of artistic skill, and of improved machinery, by which twenty colours can be printed at once, but also of an invention patented by Mr. J. Burch, of Macclesfield, of which Mr. Kay availed himself with great tact. Of course you must be aware that, in order to produce light shades of colour, the darker shades are diluted with gum-water, or reducing liquid; this was the work of the colour mixer, and therefore, to produce four colours and four shades of each colour, sixteen rollers would be required. Now the invention of Mr. Burch consists in reducing the colour upon the cloth during the process of printing. The pattern of the paler shades of each colour in a chintz design being engraved on one roller, an impression in gum-water or reducing liquid is given off upon the cloth first, the impression of the other rollers then following in the usual order; where the different colours fall upon the gum-water a lighter shade is produced, owing to the dilution of the colour on those parts, which effect may be still further heightened by more lightly engraving the corresponding parts of the colouring roller, so that a less quantity of colour shall be given off. The application of this process to furniture styles, first by Mr. Kay, and of late by Messrs. Littlewood and Wilson, and other large calico printers of Manchester, together with the substitution of the large rollers above mentioned, for block printing, has produced quite a revolution in furniture styles.

Pigment printing.—This style remained for many years in a dormant condition, owing first, to the difficulty of finding a proper fixing agent, and then to the insufficient variety of pigments, for it was necessary to find a substance which would give the pigment the required consistency, and at the same time cause it to adhere to the cloth. Artificial ultramarine was the first pigment attempted to be printed, and in 1843 india-rubber dissolved in naptha was proposed as a fixing agent for it, but owing to the danger of fire, and for other reasons, this method was abandoned. In 1847, egg albumen was introduced into this country for the same purpose, but owing to the coarseness of the ultramarine, and its high price, which was about £8 per lb. (it is now 1s. 3d.) the progress of this mode of printing was greatly retarded. In 1849, Mr. R. T. Pattison, of Glasgow, patented the use of caseine, from milk, which be called lactarine, which promoted the use of ultramarine, buff, and stone pigments in shawl printing. About the same period, another fixing agent was introduced, viz., albumen obtained from blood. The style of pigment printing, however, received an extraordinary impetus in the spring of 1859, when the purple aniline of Mr. Perkin was successfully introduced by Messrs. James Black and Co., of Glasgow, and the French purple of Messrs Guinon, Marnas, and Bonnett of Lyons, by Messrs. Walter Crum and Co., Dalglish and Co., Boyd and Hamel, Inglis and Wakefield, Heys, &c., and the splendid mauves and purples which astonished the world by their beauty, fastness, and brilliancy, were obtained by printing albumen or lactarine on muslin, and fixing the same by coagulating it by the action of steam. The pieces were then passed into the dyebeck, containing in solution Mr. Perkin's aniline purple, or Messrs. Guinon, Marnas, and Co.'s French purple, first dissolved in oxalic acid, and then added to a slightly ammoniacal bath, when the albumen or lactarine took up the colour and fixed it on the cloth, the pieces being then thoroughly washed, to remove any excess of colour. In the middle of the same year, a beautiful green pigment, which had been patented in 1858 by Mr. Guignet, was introduced, and as it is extensively employed, it may be interesting to know how this green oxide of chrome is produced. Three parts of boracic acid are intimately mixed with one part of bichromate of potash and a sufficient quantity of water to form the whole into a thick paste. It is then introduced into a furnace, and heated to a dull red heat, when a borate of potash and a borate of oxide of chrome are produced. The mass is allowed to cool, and is then thrown into cold water, when the borate of potash dissolves, and the borate of oxide of chrome is decomposed. The hydrate of oxide of chromium, $Cr_2O_3 + 3HO$, falls to the bottom as a magnificent green powder, which requires only to be well washed and drained to be ready for use. The peculiarity of this green, as well as of one prepared by Mr. Arnaudon, of Turin, from phosphate of ammonia and bichromate of potash, is that, besides being of a brilliant green, they maintain this colour by artificial light. In the month of November, 1859, the magenta colour, or fuchsine, of Messrs. Renard, was also introduced to the printing trade, and fixed by the above described method. The beautiful pinks thus obtained were soon followed by the application of roseine, azaléine, and other aniline reds. In May, 1859, a further improvement was made, which reduced the cost of applying these colours to muslins, by Mr. Walter Crum, who made the curious observation that if the gluten of wheaten flour is allowed by exposure to the atmosphere to fall into a semi-fluid condition, it dissolves easily in a weak solution of caustic soda, which solution he used as a substitute for albumen or lactarine. About the same time, Mr. Scheurer Kestner also introduced the use of gluten by the aid of weak acids, and Messrs. W. A. Perkin, and Matthew Gray, of the Dalmarnock Printing Company, proposed to fix the coal tar colours on fabrics by means of a lead soap.

Early in 1860 calico printers succeeded in printing the aniline colours directly with the animal mordants after the latter were printed and fixed, and thus were enabled not only to print a variety of colours on the same piece, but also to effect a great saving and simplicity in the operation. By this means the pigment style was fully developed, and an entirely new class of prints was introduced into this market.

Owing to the great extension of this style, the cost of the animal mordants employed became such a serious consideration as to cause anxious search for other means of fixing the colours, and Mr. Charles Lowe and myself having observed in 1856 that tanning matters would precipitate and render insoluble certain coal-tar colours, and having further observed, at the end of 1859, that tannin, when printed on cloth, and submitted to the action of steam, would become fixed, and serve as a mordant for the coal-tar colours, we took out a provisional specification on the 10th of December, 1859, for fixing the insoluble tanning compound, formed by adding a solution of gall-nuts to a coal-tar colour, on cloth prepared with oxide of tin or alumina, or other metallic oxides. For various reasons this patent was not proceeded with, but in the early part of 1861, Mr. Gratrix, with the intelligent and persevering assistance of Messrs. Butterworth and Brooks, of Manchester, succeeded in fixing aniline purples, which, though faster against soap than those printed with albumen, did not so perfectly resist the action of light. The first process used by Mr. Gratrix was, with very slight modification, the same as that described above, but his second process, which I think he preferred, was the following:—He took cloth prepared with oxide of tin, such as is generally used for steam colours, and after having printed it with a gall-nut solution, submitted it to the action of steam, when the tannin became fixed and insoluble; the pieces were then passed through a dunging liquor, washed, and then into a beck containing aniline purple mixed with a little acetic acid. As the bath was gradually carried to the boil, the colour fixed itself on the tannin, and thus produced the print, but as the whites were rather soiled, the pieces were passed into a weak acid bath, or through a weak solution of printing clearing liquor, such as is used for garancine.

Early in 1860, Mr. John Lightfoot also took out a patent to fix colours, especially those from coal-tar, by various means, the chief of which was tannate of gelatine. In 1861 patents were secured by Messrs. Pattison, Miller, and Nathaniel Lloyd, and J. G. Dale. The last of these patents is, in my opinion, one of the best which have been taken out for that purpose, and is successfully worked by Messrs. Littlewood and Wilson, of Accrington. The characteristic feature of this process is the employment of tartar emetic as the agent for fixing the aniline purple on the fabric.

It is to be regretted that the beautiful colours obtained from coal-tar should be exposed to injury in public estimation, owing to certain parties printing them with starch only, by which they are so loosely attached to the fabric, that a slight washing in pure water will entirely remove the colour and leave nothing but white cloth. By such means the reputation of this style of printing is being rapidly destroyed, and these colours, which might otherwise become a valuable addition to the printer's repertoire, are likely to lose altogether the favour of the public. This subject is so important that I cannot refrain from making another remark, viz., that if the use of coal-tar colours were properly encouraged, they would doubtless gradually decrease in price, and this country, instead of being tributary to others for its dyestuffs, would in time become the purveyor of dyeing materials, or of the substances yielding them, to the whole world.

I cannot conclude this paper without calling your attention to the immense extent to which calico printing is carried out, and the wonderful progress it has made. Thus in 1830 about 2,000,000 pieces were printed. In 1851, according to a lecture delivered before this Society by Mr. E. Potter, M.P., the estimated quantity of goods exported was 6,465,000 pieces, and the same authority estimates that in 1857 the export of printed calico amounted to about 27,000,000 of pieces.

LIST OF ALL THE SUBMARINE TELEGRAPH CABLES

Manufactured and laid down by GLASS, ELLIOT AND CO., *London.*

No	Date when laid.	From	To	Conductors.		Size of G. P. per Birmingham Wire Gauge.	Outside Wires.		Length of Cable in Statute Miles.	Length of Insulated Wire in Statute Miles.
				No.	Size.		No.	Size.		
						No.				
1	1854	Sweden	Denmark.........	3	16	2	10	2	12	36
2	1854	Italy	Corsica	6	16	1	12	1	110	660
3	1854	Corsica	Sardinia	6	16	1	12	1	10	60
4	1855	Egypt		4	16	2	10	1	10	40
5	1856	Newfoundland	Cape Breton ...	1 strand		1	12	9	85	85
6	1856	P. Edward's Island...	New Brunswick	1 do.		1	12	9	12	12
7	1857	Norway.........across	Fiords	1 do.		1	10	6	49	49
8	1857	Across mouths of ...	Danube	1 do.		1	12	9	3	3
9	1858	England	Holland	4	13	0	10	00	140	560
10	1858	Ditto	Hanover	2 strands		3	12	6½	280	560
11	1858	Norway.........across	Fiords	1 do.		1	10	6	16	16
12	1859	Alexandria		4	16	3	10	1	2	8
13	1859	England	Denmark.........	3 strands		3	12	5½	368	1104
14	1859	Sweden	Gotland	1 do.		1	12	9	64	64
15	1859	Folkestone	Boulogne.........	6 do.		3	12	0	24	144
16	1859	Liverpool...............	Holyhead	2	16	3	12	6	25	50
17	1859	Across rivers	in India	1	13	0	9	2	10	10
18	1859	Malta	Sicily	1 strand		1	10	5½	60	60
19	1859	England	Isle of Man......	1	16	2	10	6½	36	36
20	1860	Jersey	Pirou in France	1 strand		⅜	12	5½	21	21
21	1860	France......	Algiers............	1 do.		0	10	14 Steel covered with hemp.	520	529
22	1860	Corfu	Otranto	1 do.		0	10	5½	90	90
23	1861	Toulon..................	Corsica............	1 do.		0	10	14 Steel covered with hemp.	195	195
24	1861	Malta	Alexandria	1 do.		½ in.	18	11	1535	1535
									3677	5918

Messrs. GLASS and Co. say every cable manufactured and laid by them is working successfully, except the two short lines, laid in shallow water, along the shore between Liverpool and Holyhead, and from Prince Edward's Island to New Brunswick, the first of which was broken by the anchor of the Royal Charter, in the gale of wind just before she was wrecked, and the other by a ship's anchor, both of which can be easily repaired. Cables can be perfectly protected from anchors, or injury in shallow water by having the outer wires made sufficiently strong.

FRYER'S PATENT STEAM PROPELLERS.

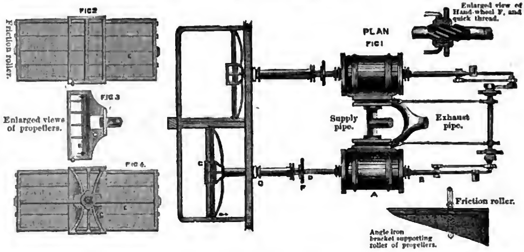


FIG 2
Friction roller.
FIG 3
Enlarged views of propellers.
FIG 4.
PLAN
FIG 1
Enlarged view of Hand-wheel F, and quick thread.
Supply pipe.
Exhaust pipe.
A
B
C
D
F
G
Friction roller.
Angle iron bracket supporting roller of propellers.

Mr. A. Fryer, of 3 Leadenhall Street, E.C., has recently patented a steam-steering propeller which bids fair to supersede the paddle-wheel and the screw, and which is not unlikely to effect a revolution in the method of propelling and steering ships. Mr. Frier's propeller requires no shaft, shaft cranks, link-motion, or heavy frame work, and does not require to be reversed in order to make the vessel to go backward. He propels, and steers the vessel by horizontal and direct acting power. His paddles are made on the principle of a duck's foot, and they are put in motion by comparatively the smallest amount of force. The steam engine is placed in the stern of a vessel, quite close to the keel, is light, and occupies but little room. The propellers are placed on each side of the rudder, and by working one or other of them, the ship can be steered entirely without the rudder. This is an important consideration after the accident which has recently happened to the Great Eastern. On account of the simplicity of the system and small amount of machinery required for the steam engine and propeller, the cost of construction and working must be considerably below those now in use. The propellers are protected from accident from shot, pieces of wreck &c., and from a heavy sea. We have seen a working model of the system at the above address, and we consider that it develops the propelling power of steam in a remarkable manner, and we shall watch with interest and anxiety, its practical application.

The above engraving represents these Propellers. Fig. 1 is a plan of the machinery; Fig. 2 a front view; Fig. 3 a Section, and Fig. 4 a back view of the propeller. *A* the cylinders, *B* the piston rod, giving direct motion to the propeller through stuffing box *C*. *D*. shews a quick thread worm for reversing the propellers *E*, by means of the hand wheel shown at *F*. *G*. the frame supporting the floats when making the forward stroke; in making the backward stroke, the floats turn edgewise, offering but little resistance to the water. The arrow shews the direction in which the propellers are supposed to be moving. These engines can also be placed transversely, one cylinder working two propellers by means of a toothed segment thereby making a safety propeller. By having the propeller reversed, so as to give a different action, the vessel will immediately be turned as if upon a pivot, even without headway, thereby rendering the ship perfectly safe without any rudder whatever.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS,

AND FOR EFFECTING ECONOMY IN THE RAISING AND USE OF STEAM.

At the last ordinary Monthly Meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, March 4th, 1862, J. M'Connel, Esq., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month there have been examined 357 engines—1 specially; 490 boilers—5 specially, 9 internally, 63 thoroughly, and 413 externally; in which the following defects have been found:—Fracture, 5 (2 dangerous); corrosion, 29 (4 dangerous); safety valves out of order, 12; water gauges ditto, 21 (5 dangerous); pressure gauges ditto, 9; feed apparatus ditto, 7; blow-off cocks ditto, 27 (1 dangerous); fusible plugs ditto, 7; furnaces out of shape, 3 (2 dangerous); Total, 120 (14 dangerous). Boilers without glass water gauges, 8; without pressure gauges, 4; without [illegible]-off cocks, 9; without back pressure valves 42.

"No less than five boilers have exploded during the last month; in one case, three working side by side being reported to have exploded simultaneously. This, as well as one of the other explosions, was attended with loss of life. Not one of the boilers in question was under the inspection of this association.

"One of them, which had worked below ground, at the bottom of colliery-shaft in the neighbourhood, I examined a few hours after the explosion had occurred, and found that the boiler which had been made in 1860, was of plain cylindrical egg-ended construction, fired underneath, the diameter being six feet, the length twenty feet, the thickness of the plates ⅜ths of an inch, and the working pressure not exceeding 40lbs.; the boiler had given way at one of the transverse seams, and rent completely into two halves; these had not flown—as they usually do in such cases—in opposite directions with their butt ends foremost, like rockets, but one half had followed the other with the open ends facing one another. It was also remarkable that the leading half had become collapsed, and the mouth so compressed that there was barely room to crawl inside. This comportment of the parts, though peculiar, appeared to me, on careful examination, to be accounted for by the very confined and unyielding chamber in which the explosion had taken place, and indications of the course the parts had taken were recorded by scars upon the arched roof.

"The cause of the explosion was not at first sight very apparent; there was no reason to conclude that the pressure had been excessive, or that injury had been occasioned from shortness of water. A boiler of such dimensions, if well made and comparatively new, as this one was, would not burst even with a pressure of 100lbs. on the square inch, while a twin boiler working alongside at the time, and to which this was connected, was left uninjured, and has since been in use again. In addition to which, the line of fracture was not the one that would have been taken by over pressure, and I therefore searched for signs of constitutional weakness at the bottom of the transverse seam, where the rent had evidently commenced. On examining this, I discovered that the plate was internally grooved at the edge of the lap, just in the same way that the double flued internally-fired boilers are so frequently found to be affected at their under side by the introduction of cold feed water. Within a few inches of this groove, just referred to (the position of which was a short distance behind the fire bridge), the feed was introduced, the feed pipe been carried down almost immediately to the bottom plate, on which the cold water thus necessarily impinged, the force of its current being increased from the fact that it was laid on from the top of the shaft, the height of which was sufficient to give it a pressure considerably in excess of that of the steam, so that in a few minutes the bottom of the boiler could be deluged with a flood of cold water. Sudden alternations of temperature in the boiler are always injurious, and it appears to me that the constant repetition of these in the present instance resulted in fracture at the bottom of the transverse seam, which instantly extended all round the boiler, and thus caused the explosion.

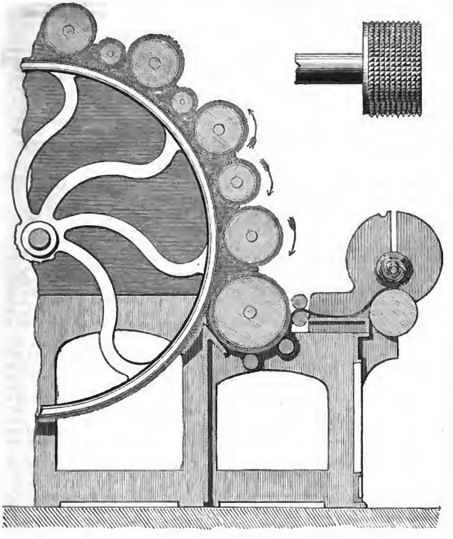
"From the foregoing, I beg to recommend that all members employing externally fired boilers should introduce the feed as far from the furnace as possible, and should not allow the water to impinge directly upon the plates, but disperse it horizontally by means of an elbow delivering near the surface of the water. Under all circumstances, it is conducive to the longevity, as well as to the safety of boilers, to raise the temperature of the feed water before its admission as nearly to that of the steam as possible.

"Since writing the above, a case of partial injury has occurred to one of the boilers under the inspection of this association, which is a further illustration of the mischief that arises from contraction of plates consequent on the sudden introduction of cold water. The boiler in question, which was of Cornish construction, and fired underneath, having been blown out at the end of the week, cold water was let into it, in order to save time in cooling, when a considerable leak was discovered at the bottom, and on examination one of the transverse seams was found to have cracked through the line of rivets for a considerable distance.

"In externally-fired boilers, if the water is blown out quickly after drawing the fires, it is quite possible for the plates at the bottom to be raised to a high temperature from the surrounding brickwork. It will be seen that internally-fired boilers are far less liable to this, since the temperature of the brickwork beneath them is never raised to the same extent as it is in the first flue of the externally-fired boiler; in addition to which, should a seam rent occur at the bottom of a Cornish boiler, the strain upon it is reduced, not only on account of the diminished area of steam pressure acting upon the ends, but also by the additional power of resistance afforded by the metal of the flues themselves, so that, while a seam rent in the case of the Cornish boiler results only in a leak, in that of the cylindrical externally-fired boiler it may result, as in the instance given above, in fatal explosion. I think it well that these points of comparison should be clearly brought out, since the system of externally-firing is not without its strong partisans, but it must be seen from the above that a boiler internally-flued, as well as internally-fired, loses nothing by the contrast either with a boiler of plain cylindrical construction, or with others externally-fired."

WILLIAMS AND PARKINSON'S CARDING ENGINE.

Fig. 1. Fig. 2.



WILLIAMS AND PARKINSON'S CARDING ENGINE.

Messrs. Williams and Parkinson, of Salford, have just patented an improvement in carding engines, which is designed for the purpose of separating therefrom the dirt and extraneous matter contained in cotton and other substances.

The improvement consists, first, in the novel application of one or more rollers beneath the "licker-in," such rollers having their surfaces subdivided by grooves in the line of circumference, and transversely, in the line of axis, so as to form teeth or projections thereupon, which act upon the cotton passing between them and the "licker-in" in such a manner as to disengage and separate the impurities therefrom, which fall into a receptacle provided for the purpose, as represented at Fig. I in the above engravings.

Secondly, the improvement consists, in the novel application and use of an extra card cylinder, a portion of which is shewn at Fig. 2, placed before the usual first top card roller, and so driven as to cause it to take the cotton from the main cylinder. The cotton is then taken from the extra roller by the usual first card roller, and fed on to the main cylinder, by which arrangement a further separation of the dirt is affected, and the cotton passes thus cleansed through the carding engine as usual, and by this means is more thoroughly carded.

ON THE RELATIVE MERITS OF THE DIFFERENT SYSTEMS OF WORKING METALLIC MINES AND COLLIERIES.[*]

By H. C. Salmon, F.G.S., F.C.S.

The relation between the industrial and political greatness of these islands and their mineral resources is too evident to require pointing out. Without our coal and iron—our copper, lead, and tin—our present industrial position would have been unattainable by any amount of skill or enterprise.

Among the mineral resources of Great Britain, coal and iron occupy by far the most important position, their value (estimating the coal at its price at the pit's mouth, and the iron as pig-iron) having been, in 1860, nearly seven and a half times as great as that of the produce of all the metallic minerals put together, estimating this metallic produce at a value after being smelted. The exact values were:—Coal, £20,010,674; pig iron £12,703,950; total value of coal and iron, £32,714,624. Value of metals produced from metallic minerals, £4,406,694, including copper, tin, lead, zinc, silver, and other miscellaneous metalliferous products.

But although the produce of our metalliferous mines seems small in comparison with that of our great coal and iron districts, it is not only still considerable in itself, but its value to the industry and trade of the country is even greater than appears from the figures at first sight. The annual out-turn of metalliferous minerals, producing metals to the value of four millions and a half, is not only a direct addition to the wealth of the country to that extent, but, coupled with our other mineral resources, it has had the effect of making this country the great centre of certain branches of metallurgical industry—a metallurgical metropolis, so to speak, to which ores are sent from every quarter of the globe, upon which our commercial and metallurgical industry realize their due profits.

In taking a brief review of the systems of working by which these great sinews of British industry are discovered and wrought, so as to be available for our use, which I propose doing this evening, I need scarcely say that I shall studiously avoid details, and confine myself, as nearly as possible, to giving a popular exposition of the general principles upon which the practical working of metallic mines and collieries is carried out, so far as the time at my disposal will permit me to do.

In comparing the modes of working metallic mines and collieries, it is necessary, in the first place, to consider the main distinguishing conditions under which the mineral deposits occur in either case. It will be sufficient, for my present purpose, to refer to two of these. The first, as to the position, with reference to their containing rocks, of the lodes or beds in which the minerals sought occur; and the second, as to the distribution of the minerals in these lodes or beds.

Now, as to the first point, the position of the lodes or beds, with reference to their containing rocks, it may be laid down, as a statement of a general fact, in this country at least, that the combustible minerals occur in beds approximately horizontal, interstratified with other beds; while the metalliferous minerals occur in lodes generally vertical or inclined at a considerable angle to the horizon, usually cutting through the rocks which they traverse. Beds of coal and its allied minerals are, in fact, sedimentary deposits contemporary with their containing rocks, while metallic lodes are of an origin long subsequent to their containing rocks, and are due to causes which science has yet failed to elucidate. I need scarcely say that, in stating that deposits of combustible minerals usually occur in beds approximately horizontal, and the metalliferous minerals, on the contrary, in lodes more or less vertical, I only profess to give a popular notion of their common mode of occurrence in this country. In numerous localities, particularly on the Continent, beds of coal are thrown, by the contortions of the strata, into positions more or less vertical, and metalliferous deposits, on the other hand, sometimes take a position nearly horizontal, and even, at times, are found in beds interstratified with their containing rock.

The second distinguishing condition—that is, the different modes in which the minerals sought for are distributed in their beds or lodes, is, in the cases of coal and the metalliferous ores, even still more characteristic than the first, for it is connected with their geological origin. The combustible mineral, being of sedimentary origin, partakes of the comparative regularity of such deposits. The metalliferous ores, on the other hand, having been introduced into the rocks long subsequently to their formation, by the operation of geological causes, highly obscure, and, probably equally complicated, usually occur with an irregularity which has hitherto defied the ingenuity of man to reduce to any general laws, and which has rendered this class of mining so eminently speculative. This distinguishing condition of comparative regularity in the one class of mining, contrasted with the widest capriciousness of distribution in the other class, stamps the mode of working to be adopted, in either case, with distinctive features, which must be always borne in mind if we wish candidly to compare the respective merits of the two systems. In metallic mines, where the deposits of valuable ores occur so irregularly—but which deposits, when found, are so valuable—the primary object is research. The removal, in the most economical manner, and with the least waste, of the ore discovered, is, of course, an important consideration; but it is decidedly secondary to the proper prosecution of works of discovery. In collieries, on the other hand, works of research are of secondary importance, the primary object being the economical and safe removal of as large a proportion as possible of the coal, the quantity of which is approximately known in most districts. Having a pretty large acquaintance with the various mining districts of the United Kingdom, and of some foreign countries, I have been greatly struck with the very different type of character which is required for successfully carrying out metallic mining and colliery mining. In the one case the essential problems to be solved are quasi-geological; in the other they are mechanical and engineering. The true metallic miner acquires, by constant practice, coupled frequently with a certain natural aptitude, an instinct—it really is but little else, being indescribable and undefinable—for the search for metallic ores, which has a value beyond all price. The possession of this acquisition is quite compatible with a general confusion of ideas on any other subject; and, in fact, it is not unfrequently developed in the highest degree in men who possess anything but clear minds—who, indeed, are quite incapable of sustained reasoning. In many metallic mining districts I have observed two types of men, the result of whose career has been very different from what a cursory observer might expect. The one would be a man of large mind, considerable abilities, and an accurate reasoner. Such a man would be an excellent engineer and a good man of business; his works, under and over ground, would be laid out skilfully and economically, and the cost of everything would be known to a fraction; yet, through a long life of industry, he would be found decidedly unsuccessful. The other would be a man of confused mind, rarely capable of giving a reason for what he did; a bad engineer and a muddling man of business. The mechanical appliances and arrangements in the mine, and at the surface, would be badly and wastefully laid out; and as to knowing the cost of the respective operations, you would generally find that the notion of estimating them had never entered into his head; yet this man would be successful where the other failed—the reason being that he possessed that peculiar mining instinct which the other, notwithstanding his superior general ability, was deficient in. The want of a clear mind, and the absence of business capacity and engineering skill, are no doubt drawbacks, but they are trifles in comparison with the possession of that indefinable knowledge, which will enable one man to discover rich bunches of ores, where the chances are the other will wholly fail. In prosperous metallic mines the courses of ore are so rich—when found—that even a considerable percentage of cost in breaking the ore and bringing it to the surface is not so very material. The great point is to find the ore, and the man who can do that best is fittest to manage a metallic mine, even if, in making the ore available when found, he should spend fifty per cent. more than another.

---

[*] Read before the Society of Arts, February 15th, 1862. Thomas Sopwith, F.R.S., in the chair.

These reasons, the force of which are not, I think, generally appreciated, coupled with the great uncertainty and irregularity of all metalliferous deposits, will, I believe, always render metallic mining inferior in its mechanical dispositions to colliery mining. Except in some extraordinary exceptional cases, it is very rare indeed that we can see our way for more than five years. An extensive mining sett may, of course, be worked successfully for scores of years, but this will generally be by a series of new discoveries, each usually requiring distinct working appliances. Consequently, as mining is a business pursued for the purpose of making money, prudent men hesitate to incur large expenses or outlays of capital for the object of making a small saving on the working of a deposit of ores which may itself disappear in the course of a short period.

Underground Working of Mines.—The systems of underground working in metallic mines and collieries thus depend upon two principal causes—the angle which the beds or veins make with the horizon, and the regularity or otherwise of their mineral contents. Indeed, the latter condition is of very general application, for all mineral deposits may be classed, for the purpose of working, according to the amount of sterile or gangue matter they contain, which may be used for the purpose of filling up, to some extent, the excavations made by workings, so as to support their walls or roofs. In the case of metallic mines, the proportion of this sterile matter is generally sufficient, with the aid of a certain proportion of timber, to secure the walls of the lodes sufficiently, particularly when the dip or "underlie" of the lode is such as to aid their standing. In the case of collieries, where the bed of coal is generally nearly horizontal, and where, besides, it consists wholly of valuable mineral, any attempt to remove the whole, or even a great portion of this, must be accompanied by a fall of the roof. Consequently, the difficulty of working collieries, so as to secure a considerable proportion of the coal, and at the same time to avoid accidents; to keep the works open, and not to prejudice the working of other parallel seams; is much greater than those unacquainted with the subject would be apt to suppose. Indeed, in the whole range of the art of mining, there is no problem so difficult, and certainly none more important. Controversies have raged on the subject, and wide diversities of opinion and practice still exist, and probably ever will exist. For my own part, I have little faith in any general rules as applied to the carrying out of operations of this nature. The conditions vary so widely in different districts and different mines, that it is only natural to expect a corresponding variety of practice; and, after all, it is only the judgment and experience of the manager that can properly decide what mode is best applicable to his own works.

The drawing on the wall will give a general idea of how the underground workings of metallic mines are carried out. In the first place a shaft is sunk from the surface, either on the inclination of the lode, or vertical, so as to intersect it at a given depth. From this levels are extended on the course of the lode, generally at regular intervals, varying from 10 to 15 fathoms, for the purpose of exploration. At certain intervals in these levels, generally from 20 to 40 fathoms apart, small interior shafts, called "winzes" in Cornwall, Devon, and in portions of Wales, and "sumps" in other districts, are sunk from level to level, partly for the purpose of exploration, and partly for the purpose of ventilation. When the ground is "laid open" by these levels and winzes, any ore ground met with is worked away, the stuff being allowed to fall into the level beneath, whence it is trammed to the shaft and drawn to the surface. The excavations left by the removal of the ore-ground are secured by timber, and the poor and waste part of the lode. The working away of ore-ground in metallic mines, consequently, rarely presents any real difficulties. When the lode is very large and rich, or when the rock containing it, or the "country," as it is technically called, is soft or "heavy," the working is sometimes attended with trouble, and always with considerable expense for timber. But there are rarely any serious difficulties, and on the whole the working away of ore-ground in metallic mines is not for one moment to be compared in difficulty with the working of coal.

As I have already stated, the modes of working coal vary almost infinitely, and have been, and are still, the subject of most lively controversies. The system most generally adopted is that of the "pillar or stall," or "board and pillar," which consists in working away a certain portion of the coal in the first instance, leaving the remainder in pillars sufficient to support the roof, which are to be permanently lost, or totally or partially removed at some future time. As Mr. Hedley says, in his work on "Colliery Mining," it is the form of these pillars, and the proportion of the coal eventually to be obtained, which cause so much controversy, and in which are involved such momentous interests, not merely for individuals, but for the future of the nation. Where this system is adopted with the eventual design of removing the whole, or nearly the whole of the pillars, the proportion of the coal got in the first instance is made chiefly to depend on collateral considerations, being varied principally to suit the nature of the roof, the character of the coal for working, and not unfrequently the requirements of other parallel seams. The present system of working large collieries is to "cut out" the seam worked in this manner, of which a notion may be formed from the drawing, from the shaft to the boundaries, and then, working backwards from the boundaries to the shaft, to remove the pillars in whole or in part. In those portions where the pillars are removed, the roof falls in, and the "goaf" is formed. This goaf, or abandoned part of the mine, is really the great danger with which colliery workings have to contend; it cannot be ventilated, and becomes consequently the receptacle of noxious and dangerous gases. The main object is to cut off the goaf as much as possible from the other workings of the mine, and, consequently, the system now generally adopted, of first cutting out the coal to the boundary, and taking away the pillars from thence, by which the goaf is left entirely behind, is a great improvement upon the old system, where a goaf was sometimes made in the middle of the workings, thus forming an enemy in the rear, cutting of retreat between existing workings to the shaft.

Transport of the Mineral Produce and Miners to the Surface.—This is a vast subject, upon which, however, I shall say little. For the reasons I have given—and I think they are valid reasons—the system of transporting minerals underground, and raising them to the surface, are less perfect in metallic mines than in collieries. The commonest system of drawing in metallic mines is by the "kibble," which is nothing more than an iron bucket attached to a chain or rope swinging free in the shaft, without any guides whatever. In inclined shafts, one side has to be planked all the way down for it to drag upon. Such a mode of drawing was suitable enough, no doubt to the days when only horse "whims" or "gins" were in use; but now that steam is universally employed for drawing from any depth, it seems to me that their use is not to be defended. Yet I am sorry to say that in most of the Cornish mines, including some of the very largest, they are still exclusively used. They are gradually giving place, however, to the "skip," made of wrought iron, and working in guides, which is undoubtedly an immense improvement. In justice to the managers of the mines, I must, however, state that the introduction of skips generally, necessitates the "cutting down," or enlargement of the shafts hitherto in use, which is a very costly matter, and one which is not unfrequently either impossible from financial considerations, or unadvisable for other reasons, such as a proximate termination of the lease. Under no circumstances do I apprehend that the systems of drawing or winding will ever be so perfect in metallic mines as in collieries. The shafts, except in a few rare instances, being necessarily sunk originally for the purposes of exploration, and being made to follow the varying dip, or "underlie," of lode, can never afford the same advantages as the those sunk vertically for the special purpose of working. Not but that I expect the systems of drawing in use in metallic mines will gradually improve, for which there is certainly scope enough; but I think, from the nature of the case, collieries will always lead the way.

(To be concluded in our next.)

The casing and extension of the rudder of the Black Prince iron frigate, is being carried out at Portsmouth with wood as an experiment.

Digitized by Google

ON THE APPLICATION OF CHARCOAL TO THE VENTILATION OF SEWERS.

(*Concluded from page* 144)

Third. The effect of the application of charcoal upon the general ventilation of the sewers is a point of the highest importance, and is, unfortunately, one upon which, after the most careful consideration of the facts elicited by the experiment, we are unable to pronounce a very positive opinion.

The necessity for sewer ventilation has already been the subject of separate reports by each of us, and, therefore, it would be superfluous to dwell now at any length upon the subject. It is merely needful here to hold in remembrance that, whilst diminishing the escape of effluvium into the streets, it is essential that the dilution of the gases generated in the sewers should not be so lessened by the diminished supply of air as to render the atmosphere of the sewers dangerous to the men who work in them; and it is also equally essential that the effluvium should not find its way more freely or in a more concentrated state into the interior of houses, by the house drains and their inlets, than it already does. These two considerations deserve attention, and may be best examined separately.

As regards the sewers, we must first state that observations made within them by means of delicate anemometers and other means, have not exhibited any perceptible currents of air through the ventilators fitted up with the charcoal sieves; and also that observations of temperature made contemporaneously in sewers with and without the charcoal boxes, have tended to show that those with the charcoal sieves were less influenced by the external atmosphere than those without them, for they were cooler in the summer months, and warmer in the winter; from which it might be inferred that the currents of air were somewhat interfered with, and that the ventilation of the sewers was not so perfect as in other cases; but it must at the same time, be stated, that the differences in respect of temperature were extremely slight.

On the other hand, there appears to have been no appreciable effect on the condition of the air within the sewers, as far as the experience and observations of the workmen have gone; for no complaints of a worse atmosphere have been made by them.

Chemical and physical considerations indeed would lead us to the conclusion that, although the coarsely-granulated charcoal may offer some slight resistance in the passage of an actual current of air, it cannot effect the diffusive power of gases, which is so largely concerned in maintaining the chemical equilibrium of the atmosphere; in fact, experiment has shown that media much denser than charcoal, will permit of the free interchange of air, and of the quick dilution of noxious effluvia. Again, the chemical condition of the internal atmosphere of the sewers, as far as analyses have gone, show a proportion of 79·96 per cent. of nitrogen, 19·51 per cent. of oxygen, and 0·53 per cent. of carbonic acid, with traces of ammonia, marsh gas, and sulphuretted hydrogen. There is, therefore, abundance of oxygen to maintain the functions of life.

We believe, therefore, we are justified in the conclusion that the danger to the workmen in the sewers has not been materially increased by the application of charcoal to the ventilators. How far they would obstruct the passage of a large quantity of coal gas escaping into the sewers is yet a matter for observation. This gas is at all times dangerous, and is most frequently the cause of sewer accidents by explosion; fortunately, however, the presence of it is betrayed by its odour long before it reaches a dangerous proportion, and, with due precaution, the risk of its exploding may be avoided.

And here, while discussing the accidents which are incidental to the presence of foul gases in the sewers, it may not be out of place to speak a little more fully concerning the safety of those who are exposed to them.

The deadly and morbific effect of concentrated sewers' gases is, unfortunately, a matter of common experience. Again and again it has happened that these gases have killed with the energy of the most deadly poisons. In France the fatal effects of sewer and cesspool miasms have been frequently observed; and the writings of Portal, Gériel, Labouire, Parmentier, Alibert, Dupuytren, Cade de Vaux, Hallé, Geraud, Parent-Duchâtelet, Chevalier, D'Arcet, Orfilla, Devergie, and others abound with instances of the fatal *mephitismes*, caused by the gases from the *fosses d'aisances*. In this country such accidents are of much rarer occurrence; for over a period of sixty years there have been but five such accidents in the sewers of this metropolis. These, however, were the cause of eighteen deaths. One of these accidents occurred about a year ago in the Sewer of Fleet-lane, and it was the first upon record within the sewers of this city. We have but little knowledge of the immediate cause of that accident, for the four men who were killed were the only persons in the sewer, and they seem to have died instantly; but the inquiries which were instituted at the time suggested the necessity for some protection against a similar disaster.

The experience of our present investigations, as well as the results of laboratory experiments, point to the advantage which may be derived from the use of an apparatus in the form of a respirator, containing charcoal. Dr. Stenhouse has already contrived such an apparatus; and we believe that it might be resorted to by the men in times of danger, as when there is an odour of foul gas, and would afford them an opportunity of quitting the dangerous locality and reaching a place of safety. It is very probable that under the worst circumstances, when the air is charged with a large proportion of sulphuretted hydrogen, there is still enough oxygen to maintain the functions of respiration: the danger indeed, is not from the absence of atmospheric oxygen, but from the presence of sulphuretted hydrogen, and this the charcoal of the respirator would destroy. It is desirable, therefore, that each of the sewer men be provided with a respirator of this construction, and be advised to use it when the air of the sewer is expected to be unusually offensive, and when they are disturbing large deposits of mud. There will be, doubtless, difficulty in compelling men to use these precautions; but if they are provided for their use, the Commission will have the satisfaction, should an accident occur again, of knowing that they have done the utmost in their power to prevent it.

The second part of this branch of the inquiry is as to the effect the introduction of the system has had upon the sanitory condition of the houses, as regards the escape of sewer gases into them from the drains. Upon this head our information is of a negative character. All that can be said is, that we have had no evidence of increase of effluvium in the interior of dwellings; nor do the mortality or sickness returns indicate an unusual amount of disease of a pythogenic character. Unfortunately, as has been pointed out by your Engineer, in his Report on the Ventilation of Sewers, there are evidences that from most of the house drains, even in the houses of the better classes, where the inlets are supposed to be properly protected, effluvium periodically escapes into the dwellings and is the cause of mischief; but that such escape has been in excess in the district alluded to, we can discover no proof.

As to the effects of the diluted gases when they find their way into dwellings, little need now be said; for the Medical Officer has already discussed the subject in his Report of 1858, on Sewage and Sewer Gases. Abundant evidence is there produced of the disease-producing agency of the diluted effluvium; and the sad experience of the last few months is sufficient to show how those gases may exert their action in places where they are hardly suspected to exist. It can no longer be doubted, after the experiments of Dr. Barker, and the clinical observations of Dr. Murchison, that these gases are concerned in producing a form of continued fever, which is very aptly termed from the cause, *pythogenic*. This fever is often seen in the filthy haunts of poverty, wher corruption is abundant; and its ravages are in proportion to the defective state of the drains and sewers. Twelve years ago, when Mr. Simon reported to you on the matter, he remarked that the constant prevalence of fever in certain courts and alleys of this city told, without reference to the Surveyor's Plan of the Sewers, that they were then destitute of the means of perfect drainage; and the occurrence of typhoid or gastric fever, even in the houses of the rich, is a matter for grave suspicion as to the state of the cesspools or the house drains and their appliances.

These considerations force upon our minds the conclusion, that wherever there is an escape of gases from the private drains or the public sewers, it is of the utmost importance that those gases should be destroyed as far as practicable; and we are of opinion that by the application of these charcoal filters a remedy may in numerous cases be found.

Fourth. With respect to the cost of the process.—The expenditure incurred in fitting up the 104 ventilating shafts was £918 18s. 5d., which is at the rate of about £8 16s. 8d. per ventilator. An experiment is necessarily more costly than an established system, and a much less sum than this may be taken as a fair average of the probable expense of extending the process even to the whole of the City, where, as may be gathered from what we have before said, the difficulties in the adaptation of the existing ventilators are considerable, and the cost, therefore, large. The charges named will not, therefore, serve for estimating the cost of adapting the shafts in districts which are less dense, and in streets which are less encumbered. Still less will it furnish an indication of the cost of the system when applied to new sewers, which may hereafter be constructed with the especial view to adopting it. In the latter case, the cost, under well-considered arrangements, would be very moderate.

The total expense of reparation and renewal of damaged trays, frames, and coverings, averaged 16s. 6d. per ventilator, per annum. The cost of supervision, supplying, and changing the charcoal, was 8s. 9d. per ventilator, making together £1 5s. 3d. per ventilator per annum. The very large cost for reparation was mainly attributable to the repeated breakages of one class of apparatus used, which is not found to be capable of standing the severe traffic of the city thoroughfares. This item might, therefore, at a future day, be considerably lessened; but if the process should be still applied in the manner herein detailed, much annual expense will always have to be incurred. We are confident, however, that, with the experience already obtained, a more economical and effective mode of applying the process at the sides of the public way, or otherwise as suggested, might be adopted; and in that case the expense of reparation might probably be reduced by two-thirds, and that of maintenance would be very considerably reduced likewise.

Our general conclusions from these experiments, and from the consideration of collateral evidence, are, that dry charcoal, in the presence of atmospheric air, is a powerful means of destroying the mephitic gases and vapours of sewers and drains. That the charcoal filters may be used with efficacy in the course of the air channels from the drains and closets of houses, as well as in the ventilation of the public sewers; that in applying the charcoal, those contrivances should be used which offer the least resistance to the free passage of the air; that the situation of the filters is best where the charcoal is protected from wet and from dirt, and is easily accessible; that from the ascertained efficacy of charcoal in destroying the dangerous emanations from sewers, the system may be generally applied with great advantage; and that from the experience derived from this extensive practical inquiry, we are satisfied that the expense of the system might be considerably reduced below that indicated by the cost of the experiment.

STEEL RAILS FOR RAILWAYS.

One of the most important items in the cost of railway maintenance is the renewal of rails, and it is therefore natural that much attention should have been paid to the various methods proposed for giving greater durability to the rail. Experience has shown the want of some means by which their duration could be prolonged, and in the manufacture of rails it is now always expected that the quality of the material and the method of piling shall be distinctly stated before any large amount of work is undertaken.

No ordinary material or method of piling or making the finished rail will however resist the crushing action of modern locomotives, and extraordinary means have been sought to accomplish this much desired object. Amongst the most important of the methods hitherto used for this purpose is that of forming the wearing surface of the rail entirely of steel, by introducing a bar of steel into the pile, and rolling it out so as to unite it with the iron body of the rail. Another method is to submit the surface of the ordinary iron rail to a process of conversion in a furnace specially adapted, thereby case-hardening the outer coat or skin of the wearing portion of the rail. Both of these processes have many advocates, and to a certain extent they fulfil their object; still they are open to the serious objection that only the crust or skin of the rail is rendered hard, and they do not prevent the body of the rail from yielding to the severe pressure of the wheels; lamination and splitting are only to a small extent diminished, and though the life of the rail is prolonged, the prolongation is uncertain. The same objections apply to the puddled steel rail, and it is also liable to vary considerably in its hardness, and to be at times too brittle for perfect safety. This liability to vary in quality is inseparable from the mode of manufacture as at present practised; and though many very good rails of this kind have been produced, the want of certainty in the manufacturing process seriously diminishes its value.

Cast steel rails, made by Mr. J. Brown, Sheffield, have been laid about six or seven months at the new Pimlico Railway Station, in London, and proved very satisfactory. They are in as good condition now as when laid down. A set of steel points and crossings has also been in constant use for seven months at the same station.

Cast stell rails are not an entire novelty; several years ago a few were made at Ebbw Vale, and were laid at the bridge at the north end of the Derby station, and there they are at the present time perfectly sound and good, whilst the neighbouring iron rails have been many times worn out and replaced. But these rails were made at a great expense, from ingots cast in the old or usual method, and the imperfect appliances then existing made it impossible to introduce them commercially. Still the experiment at Ebbw Vale has clearly proved the far greater power of resisting wear and tear possessed by the steel rails, which bid fair to become in truth a really "permanent way."

A series of experiments, says the *Times*, have been carried out on board several of the screw gunboats belonging to the Steam Reserve, at Chatham, by direction of the Admiralty, for the purpose of ascertaining the comparative advantages of wood and coat as fuel in getting up steam. The object more particularly kept in view was to ascertain whether, in the event of a fleet of gunboats being suddenly despatched to the Canadian lakes, wood is likely to prove more economical than coal. The result of the trials, so far as they have been carried, has been in the highest degree satisfactory. It has been ascertained that, in using the ordinary pitch pine-wood which abounds in Canada, steam can be generated in the boilers in about half the time necessary when coal alone is used.

Mr. Robert Dodwell, of Manchester, has published an illustrated hand-book to the Electric Telegraph. The book appears to be a reflex of lectures which that gentleman has from time to time delivered in the North of England.

THE ARMSTRONG GUN.

PART II.

TESTING THE RELIABILITY OF SIR WILLIAM ARMSTRONG'S REPLY.

(*Continued from page* 140.)

If we now proceed to reconcile the writer's and Captain Coles' lists of breeches disabled in the September cupola experiment, by adding to the former, the one which gave way in the attendant gunboat, we shall then find that the whole number of twelve constitutes practically one-third of the entire list of thirty-seven enumerated in his Table 2; and more than one-half of those from all naval guns; and we may therefore test the value of the statement that the list "is made up of breeches more or less worn out in honourable service" by noting the number of rounds severally withstood by these twelve breeches before being "disabled;" bearing in mind that this was both the first, and as yet the only, instance of making any representation whatever with these guns, of naval warfare:—There were

Disabled in 19 rounds each	Three.
" 16 rounds....................	One.
" 14 rounds....................	One.
" 10 rounds....................	One.
" 6 rounds....................	One.
" 3 rounds each	Three.
" 2 rounds each	Two.

In no case did a breech either of steel or wrought iron withstand twenty rounds. Is it then the paid Government inspector, or is it the contractor, who pronounces this to be "honourable service?"

It is scarce six months since all steel breeches for naval 100-pounder and 40-pounder Armstrongs were ordered to be replaced by those of wrought iron, as those of wrought iron have been, since last September, ordered to be replaced by those on the sandwich pattern; since which all available lathes at Woolwich have been engaged, at one time night and day I am informed, to give effect to this order. The first result with these which I have just stated seems thus to disclose to us that all efforts to find some safe and durable material for the breech of these larger guns are at present of the nature of a mere "*pis aller.*"

How far Sir William in respect to his two tables, now done with, has or has not fulfilled that introductory promise to his "readers" of "letting them know all he can," such of them as peruse these pages, "may," in his own words, "now judge for themselves."

I proceed to illustrate the attendant circumstances to which these breech accidents give rise, first quoting, for the purpose of subsequent contrast, the following passage from the writer:—"Rare as have been the cases in which the success of the gun has not been complete, I take more pleasure still in the fact that a new system of rifled artillery, with its new projectiles, fuses, and accessories, has been introduced, and so far perfected, without loss of either life or limb, or even injury to a singular individual.—Two casualties which happened on board the Excellent, and were at the time described as of this nature, were not instances of vent-pieces being blown out, but of the handles being blown off from neglect in screwing up the breech."

An eye-witness, and a participant of these same two casualties, speaks of them as follows—Admitting the neglect of the captain of the gun in not "screwing up the breech," he says of it: "His attention having been withdrawn from that important duty by the necessity of replacing the bed, it having been *displaced by the previous discharge*, and not trying the breech-screw, *thinking it had been done previously.*" He then goes on: "When the gun was fired, the *vent-piece, i.e.* breech (not its handle only), blew up into the beams overhead, where it fortunately encountered an iron bolt, which impeded its further progress, or it would most probably have gone up through. The flames rushed out at the breech, and set fire to the lower part of the clothing of the captain of the gun. Several others were slightly injured at the gun; all movables were thrown down, or broken. The cutlass party were at drill on the upper deck; and several fell down by the shock. The above was a 40-pounder, and occurred on board the Illustrious, attached to the Excellent. Another accident of a similar kind took place about two months previous at a 20-pounder on the middle-deck of the Excellent; and its cause and effect were the same, but no one hurt, though several were thrown down by the explosion." Then follows the practical effect of these self-produced casualties on a large and intelligent class of the professional mind by no means prejudiced against the weapon itself: "I have every confidence in the guns in every respect, *provided they are well served. I fear that in action, with firing quickly, the breeches would not be properly screwed up, and sometimes not at all.* I hope some means may be devised that the gun cannot be fired without the *breech being secured.*" Here again follows a practical comment on the "escape of gas" from Armstrongs when used between decks: "The smoke, also, is almost stifling, and has nearly the same effect on the senses as a Russian carcass. That is caused by the lubricating wad, which is made of two parts sawdust and one of tallow, and placed between the projectile and cartridge, or made up in it." This is spoken, be it observed, of lubricator experience, previous to Colonel Boxer's recently introduced "improvement," which, in addition to its compounds of brass, solder, wood, felt, tallow, and beeswax, already stated, I now find to consist of oil, glue, and pasteboard besides.

When the writer of the reply penned the passages I last quoted from him, was he or was he not aware of the real nature of the casualties described in so irreconcileable a manner by himself and by an eye-witness? If unaware of such realities, does his position render his ignorance justifiable? But in either case we have here another stern proof of that peculiar confidence with which, at least in his letter, he bears himself before the public when purporting to relate the realities of his gun.

These casualties occurred to guns whose extreme charges are 15 lbs. and 3 lbs. only; are they the less likely to occur, or with less serious consequences if they do, to the 100-pounder with its 14lb. charge?

They took place with instructor gunners training for the fleet, not with "recruits."

They have been followed up by casualties in the Marlborough, the Queen, and the Edgar; perhaps in others also, but, as the particulars of these have not yet been procured with accuracy, they are at present withheld. It is publicly stated, however, that five men were injured by the "escape" from the Marlborough's Armstrong.

And in the September experiments on the Trusty, the explosion, on the destruction of one of the breeches, singed the face of the gunnery lieutenant when 9 feet in rear of the gun.

I now proceed to test the reliability of the writer's account on the proof of endurance his guns have undergone. He says—

> Your readers will be interested in an account of some official tests of endurance to which one 100-pounder, two 40-pounders, and two 12-pounders not long ago were submitted. The 100-pounder (weighing only 81 cwt.) was fired 100 *consecutive rounds* with the full service charge of 14 lbs. The *projectile* for the first ten rounds was of 100 lbs. weight, and was increased by 100 lbs. every ten rounds after, so that from the ninetieth to the hundredth round it weighed 1,000 lbs. and projected two feet from the muzzle. The gun, after sustaining this extraordinary test *without injury*, might have been merely passed into the service, but was taken for the severe duty of *proving vent-pieces*, and daily endures a repetiton of full proof or double service charges of 28 lbs.

Here, as before, follows another version of the same event, with the difference, however, that in this case both must have had a common source: had they or had they not a common author?

> 30th October, 1861.
>
> (*Endurance under testing of a 100-pounder Armstrong Breech-loading Gun.*)
>
> My Lords Commissioners of the Admiralty desire that the following particulars as to the testing for endurance of an Armstrong 100-pounder breech-loading gun be communicated for the information of the officers and crews of Her Majesty's ships.
>
> The proof of this gun, *which was conducted in the usual manner* (!) was commenced on the 20th June last, and was carried on until 100 rounds had been completed on the 10th September last.
>
> The charge of powder used was the service-charge of the gun for shot of 100 lbs., as originally proposed by Sir William Armstrong, viz. 14 lbs., which will not be exceeded for shot of 110 lbs.
>
> For the first ten rounds, *cylinders* of 100 lbs. were employed; for the next ten, *cylinders* of 200 lbs., and so on up to the last ten, for which *cylinders* of no less than 1,000 lbs. were employed. These last were 8 feet 8 inches long, and projected 2 feet beyond the muzzle.
>
> The gun was found to be uninjured. The powder-chamber and shot-chamber were found slightly seamed in the direction of the grain of the iron. The breech-screw worked freely throughout the experiment; it is hollowed on the face, but hardly perceptibly.
>
> Two steel vent-pieces were broken in the course of this experiment, viz. at the 28th and 31st rounds respectively; one wrought-iron vent-piece, after being used from the 32nd to the 81st round, was found so much worn on the face as to injure the cups, and a second wrought-iron vent-piece was used from the 82nd to the 100th round. This vent-piece was observed at the 91st round to exhibit a number of fine cracks, which extended considerably in the course of the remaining nine rounds. It broke at the fourth round of a subsequent experiment with proof-charges of 27½ lbs., and single proof shot 110 lbs.
>
> The breech-copper required refacing at the 30th round; after the 35th round it was removed and replaced. At the 58th round the new copper was refaced, and replaced after the 63rd round; the copper then put in received no repairs

Digitized by Google

> during the rest of the experiments. Lubricating wads of the service-pattern were used for the first ten rounds; afterwards, those of Captain Lyon's pattern.
>
> The powder-chamber was washed out after each round to allow the expansion of the breech-copper to be measured
>
> Cups of *strong tinned plate* were used for the first 35 rounds, but were *too weak* to resist the pressure exerted by the gas with cylinders of the weight then in use, and were replaced by *copper cups*, which answered well for the remainder of the trial, being *seldom* broken.
>
> The recoil, as the experiments advanced, became very violent, the suspending rods ultimately were removed, and the gun was placed on a species of carriage, which recoiled up a steep inclined plane checked by sand. It is stated however by the inspector of artillery that great difficulty was found in completing the experiment even with this arrangement.
>
> The gun used on these experiments was of Elswick manufacture, made entirely on the coil principle, and weighed 81 cwt. 3 qrs. 16 lbs., and was of the usual external dimensions.
>
> *The remarkable strength exhibited by this gun is very satisfactory, and would appear to leave nothing in that respect to be desired except some improvement in the vent-pieces, which every endeavour is being made to effect."*

For the promulgation of this Circular I believe the public to be much indebted. Thus.—

The writer's reply states that the 100 rounds were "consecutive." The circular shows them to have occupied *eighty-two days*, out of which, if we deduct fifteen for Sundays, &c., we get sixty-seven days, or an average of two rounds for every three days, indicating that the gun might never have been even warm throughout the trial. These rounds would have been "consecutive," no doubt, if even a month had elapsed between each; but the word conveys to the public—like the "vent-piece"—a very different meaning from that reality which the statement of the circular discloses; and this non-natural use of language I find to be more or less characteristic of the reply throughout.

The letter states that *projectiles* were used; the circular shows that cylinders were used throughout. The former word invariably means ordinary service missiles of shot or shell; the latter applies to the mere experimental circular bars of iron used at this trial. The 110 lbs. service-shot *projectile*, throughout nine inches of its length, is ·12 of an inch larger in diameter than the barrel through which it is to be forced. The cylinders used were considerably smaller in diameter than the barrel, with the exception of a portion of lead at the rear end only, and only at one spot of that portion was the diameter ·04 of an inch larger than that of the barrel, just sufficient to prevent the charge from escaping unconsumed through the 10½ inches of grooving. The cylinders were laid along the bore *before* firing, not forced from end to end through it *by the discharge itself*, as with all true Armstrong projectiles. The "rifling by explosion," which is the principle, and therefore must constitute a chief feature in any true test of the gun, was thus not even provided for, but, on the contrary, seems rather to have been provided against. Thus the gun throughout was never subjected to that stretching tear of its inner tube which a single round with the service-shot and full charge produces; and twenty-five rapid rounds of service-firing—which would have been a far more practical proof of what the gun must really undergo—might have reduced it to that distressed condition in which a friend of mine recently witnessed the arrival at Woolwich Hospital of another "Elswick" 100-pounder for treatment, viz., with its inner tube projecting six inches.

In reference to the expression used in the circular of "proof conducted in the usual manner," I here beg to express doubts as to the efficiency of the Woolwich proof for naval Armstrongs altogether. The diameter of the "proof-shot" is reduced—probably to the extent practised on these cylinders—for the purpose, as is stated, of making room behind it for a proof-charge of 27 lbs. instead of the service one of 14 lbs. only. The proof-shot before firing is thus thrust into the bore by hand to where the service-shot can only be driven by powder, and it can, therefore, never test the barrel so truthfully as this latter. The charge itself too will be consumed within the barrel in proportion to the time allowed for its consumption, and that time will be greater or less as the shot it drives is hard or easy to expel. The reduction of the diameter also allows a larger amount of the charge to be driven unconsumed through the grooving. Thus the proof-shot with proof-charge may in reality be proving the gun less faithfully than its first service-charge and service-shot—a mode of proof-practice for heavy artillery very different from that imposed for safety on every fowling-piece.

The letter and the circular both agree in representing the gun as "uninjured after this extraordinary test." The letter is entirely silent as to any occurrences worthy of note during the entire trial. The circular, on the contrary, furnishes the following facts whereby to judge for ourselves whether the expression "uninjured" is again a natural or *non-natural* description to be publicly put forth after what seems to have really taken place at this supreme trial of naval Armstrong's; during which the gun must have been undergoing a constant recurrence of repair, and may well have required eighty-two days to deliver its 100 *consecutive* shots.

1st. The circular states "the powder-chamber and shot-chamber were found slightly seamed in the direction of the grain of the iron." And is it not in this direction that all structures of iron, such as cables, anchors, &c., on which naval safety so much depends, begin to seam and decay?

2nd. "The breech-screw" was "hollowed on its (annular) face, but hardly perceptibly." Perhaps so to the eye, but not the less decidedly so to the breech which had thus to rely on a doubly-hollow support. Witness the strength of that "gas-escape," uncontrolled by *strong tin* and not always by *copper*.

3rd. Two steel breeches were broken, the one lasting twenty-eight and the other three rounds.

4th. Two wrought-iron breeches were practically "worn out," the first by forty-nine rounds, during many of which it seems to have been injuring the "cups"—which on service it could not have been permitted to do at all—the second by nine rounds; but as it then exhibited *only* a number of fine cracks, which extended considerably, it was made to last out the remaining nine rounds of the trial.

5th. At the thirtieth round the gun disabled the copper breech-ring of its barrel at the junction with the breech, which had then to be "refaced;" a nice operation, occupying an accomplished artificer at least half an hour.

6th. At the thirty-fifth round—five rounds more—the gun disabled itself in the same way and place; but the breech-ring had this time to be altogether removed and replaced.

These breech-rings of the Armstrong whence once screwed in are presumed never to be screwed out again or even started; but, when requiring to be replaced, a special instrument must be used for the purpose, by which the defective ring is bored out with great nicety, close to its thread, which is then "picked out" from the bore with equal nicety, lest the female thread for its successor be injured. An accomplished artificer can alone perform this process, which occupies many hours, during which, as in the shorter process of "refacing," the gun is entirely useless. This form of self-disabling results from the incurable "escape of gas" at the junction of the breech and barrel—even with "cups" of special strength apparently—the highly elastic fluid having a mechanical effect in cutting the copper. It frequently occurs also as an additional disaster, when the breech itself gives way.

7th. After twenty-three rounds, this new breech-required to be refaced; and

8th. After five rounds more, the second breech-ring had to be replaced with a third, which appears to have lasted the remaining thirty-seven rounds of the trial; but its then state is not described.

On this proof, then, the so-called "uninjured" gun disabled itself four times by rendering "unserviceable" two breeches of steel and two of iron. Four times it disabled itself at the junction of the breech with barrel. That it did not equally exhibit its third fatal point of structural self-injury, viz., the stretching of the core of the barrel itself, seems to have been only because this proof by cylinders, instead of by service-shot, was calculated—not to do so. The circular which thus unwittingly shows us that a serious casualty—each of which must have more or less hazarded the result of any action—took place on an average of every twelve and a half rounds in a total of 100, fired at a mean rate of three every two days; publicly promulgates this result to all concerned as a "very satisfactory" exhibition of "remarkable strength, leaving," on the 30th of last October, "nothing to be desired except some improvement in the breeches, which every endeavour is being made," by the sandwich mixture then preparing "to effect." The *naiveté* of such a conclusion to a circular which discloses such a result, making it impossible to resist the observation—When will it be known within the precincts of certain localities, that when mechanical combinations are put to proof, their true practical strength is exhibited, not by the holding together of the strongest parts of their structure, but by the giving way of their weakest?

I think also that this confidence circular, as it may be termed, issued for the purpose of justifying the naval Armstrong gun when thus read by the light of a little practical knowledge, gives proof of the need, in high places, for some permanent proof-master to watch over the introduction of new artillery for the navy—one who shall be a safe guide to others, as well as qualified to discern for himself what is from what is not a true breech, together with the importance of its being as durable as the sides of the barrel.

I pass by the minor casualties disclosed by the circular, and indicated by the change of "lubricators," the change of "cups," and the change to meet the "violence of recoil" in a cold gun; all of them, no doubt, requisite for even such a result as has been shown us. Neither is it for me to give judgment between the letter and the circular as to the utterly different accounts they place before the public of one and the same event; to be the reconciler, in the writer's own words, between "simple truth" and "decorative ornaments;" and to determine whether it has been in the interests of the public or of the contractor, that there is here again what appears so much like a grave omission of facts by one who—as on a former occasion—must surely have been "a close observer of what took place."

I have given both narrations complete that all "may judge for themselves," without seeming injustice to either; but, ruled by former experience, I give faith myself to the circular; and the more so, from the significant fact that this endurance proof, together with the simultaneous results of the cupola trials in the Trusty, produced the recent order, not only for the iron breeches to be replaced by those of "sandwich metal" in all naval 100-pounders and 40-pounders, but for the copper breech-rings in those guns to be also replaced by breech-rings of iron, as is now being done. And it seems impossible to look on this change also as being any better than in the nature of another *pis aller*.

If iron were known to be the proper material at that important junction point between the barrel and the breech, why not have left there the solid material of the barrel itself? Why remove a ring of solid iron, to be replaced by a screwed and jointed one of copper, and then remove this copper one also, to be replaced by iron as before, only, instead of being solid, to be screwed and jointed at that very point where the destructive gases of discharge take their fullest effect? Surely such orders as these, relative to such important parts, proclaim in strong terms that the gun has never undergone as yet such proof as ought in reason to have preceded its national adoption; and that its supply to the fleet in such a state of uncertainty, even as to material for its structure, is entirely premature, whether future efforts ever do or do not make it a serviceable fighting weapon at all.

(*To be concluded in our next.*)

Telegraphic Intelligence.

About a week ago, a letter appeared in two of our contemporaries, signed by Mr. Tal. P. Shaffner, in which it was stated that the Malta and Alexandria telegraph cable was incapable of being worked throughout its entire length as a single electrical circuit, and giving that circumstance as the reason why Glass, Elliot, and Co., who are responsible for the commercial working of the cable for five years, had landed it in three sections, with intermediate stations at Tripoli and Benghazi. Mr. Shaffner, who is the owner of the concession for the North Atlantic scheme by way of Iceland, Greenland, and Labrador, argues from this that to telegraph commercially between the termini of the original Atlantic Telegraph Company (Ireland and Newfoundland), a distance of 1,640 nautical miles, would be impossible. Mr. Shaffner's letter, however, was speedily followed by one from Mr. Saward, the secretary of the Atlantic Company, who refutes these statements by publishing replies, received in answer to his enquiries on the subject, from the Gutta-Percha Company, and Glass, Elliott, and Company, respectively. The former state that they would be prepared to guarantee the efficient and satisfactory working of 2,100 miles of insulated telegraph wire, manufactured by themselves, and maintained in that state; while the latter firm certify that the entire line of 1,535 miles, between Malta and Alexandria, can be worked through, without relay or repetition, in an efficient and satisfactory manner, both as regards its scientific and commercial results, and with remarkably low battery power. They further observe that they would have much preferred to work it in that way as a single continuous line, but were obliged to lay it in sections, in obedience to the directions of the Government, who expected a large business to arise at Tripoli and Benghazi, and who thought that by this means an easy communication by telegraph might hereafter be established to Algeria. Messrs. Glass and Co. then state that, so confident are they that Ireland and Newfoundland can be connected by a good and durable cable, that they are willing to contract to do the work, and to stake a large sum upon its *successful laying and working*. This would seem to be an answer to Mr. Shaffner's objections, as the firms above quoted possess a vast amount of experience upon these questions, and have also the resources enabling them to be fully responsible for all they may contract to perform.

We have inserted a letter from Mr. Shaffner on the subject in another column.

UNITING AMERICA, ASIA, AND EUROPE, BY TELEGRAPH THROUGH THE NORTH PACIFIC OCEAN.

While Colonel Shaffner is doing his best to connect Europe and America by a telegraph cable, *via* the Faroe Islands, Iceland, and Greenland, other Americans are endeavouring to tie the two continents together in another direction. Mr. Perry M'D Collins, has recently presented a memorial to the United States Congress, in which he solicits authority to survey and explore the coasts, seas, islands, and harbours, as well as a reconnissance on land of the North Pacific. The memorial is an elaborate document and is worthy the perusal and consideration of all interested in the great telegraphic enterprise.

In order to develope American commerce in N.E. Asia, and an overland telegraph communication between Europe and America, he visited Russia twice since his first voyage to the Amoor, and presented to the imperial government the plan of the Russo-American overland telegraph from Moscow to St. Louis.

The Russian government responded in part to the plan proposed, and authorised him to survey and explore such portions of the proposed route as lie between the mouth of the Amoor river in Asia and the confines of Russian territory in America.

The North Pacific Ocean presents a vast field for commercial expansion, yet much of it is comparatively little known, and but partially surveyed or sounded. To this ocean a large number of ships resort yearly, in search of whales, while the opening of Japan and the Amoor to commerce has added a number of merchant vessels.

The Aleutian Islands, which afford stepping stones from America to Kamschatka, are but the prolongation of a sister chain of islands, the Kuriles, that reach from Japan to Kamschatka. These two chains of islands, shut out, as it were, the northern waters of the Pacific from the great ocean itself, affording innumerable bays, gulfs, seas and harbours, where adventurous seamen may pursue whales and capture them.

The island of Sah-ka-lin or Tarakay, which lies to the north of the Japanese group, shuts in from the Pacific the northern portion of the Japanese Sea and the coast of Mantchuria, including the mouth of the Amoor river. This is the only outlet to the ocean of that system of rivers which drain the very best portion of N.E. Asia, and open a highway into the interior of Tartary and Asiatic Russia. Hakodadi, which lies on the line of navigation for vessels penetrating the Ochotsk Sea on visiting the Amoor, is only from two to three days' sail for steamers from De Castries or the mouth of the Amoor.

The object of the survey will be to ascertain a practicable roadway, as it were, for the route of the proposed telegraph, starting from Russian America and progressing towards the Amoor. It is suggested there should be a land as well as a sea survey, the expedition to be fitted out at San Francisco and proceed thence, touching at Sitka, the capital of Russian America, to confer with the Russian authorities at that point.

The petitioner says a coast line as well as deep sea crossings should be surveyed and sounded, the soundings to be at three or four several points. First, *via* the Aleutian Islands or such of them as may be considered advisable on which to have telegraphic stations in crossing from Cape Alyaska *viâ* Said Islands to Kamschatka. Second, from the American shore, in about 60° N. lat. at Nunivak to Oulantersky, on the coast of Kamschatka. Third, from the mouth of the Noicbpak river, or Norton Cape, on the American coast, to the Island St. Lawrence, in the sea of Kamschatka. Fourth, from East Cape, on the Asiatic coast, to Cape Prince of Wales on the American coast, which is in Behring Strait, the narrowest point of intervening water between the two continents, measuring but thirty-nine miles from land in America to land in Asia. This examination will include such points on the coast of Kamschatka as lie opposite to America on the line or lines of survey.

The next step will be to examine the West coast of Kamschatka at or near Bolcherisk, and sound thence to the north point of the island of Sak-ha-lin, or to a point on that island more directly opposite the mouth of the Amoor river at its entrance into the strait of Tartary. Also a survey from the vicinity of Cape Lopatka, the southern point of Kamschatka, *via* the Kurile Islands, or such of them as may be necessary in view of telegraphic stations thereon, and thence to Cape Patience, on the southern point of Sak-ha-lin, on the strait of La Perouse.

The coast of the island Sak-ha-lin on the western side, fronting the sea of Japan and the strait of Tartary, should be examined in lieu of a shore or land line; but it is supposed that from the Russian settlements and surveys made by the Russian government all necessary information can be obtained in relation thereto.

Thus, says Mr. Collins, by a survey and expedition, both by land and sea, from the shores of America to the mouth of the Amoor, a vast work would be accomplished, advantageous to our commerce and civilization; science would be vastly benefited and knowledge among men would be much increased; our adventurous whaling and merchant ships would reap the benefit for all time of this government survey, guiding them in their perilous voyages and saving many from shipwreck, and much consequent loss of life. In view, therefore of the foregoing premises, and in furtherance of American commerce and enterprise, as well as the vast benefits to result to us as a great commercial nation, to grow out of the fact of a telegraphic communication which shall not only unite Europe with America, but add the whole of Asia, including China and Japan, your petitioner respectfully asks the favourable consideration of the Congress of the United States of America.

TO CORRESPONDENTS.

Received.—Capt. N., W. H. R., W. R., W. H., J. A. D., G. M., F. S., H. A., W. & H., M. R., R. C. for Dr. W., G. C., G. W., F. A. F., J. A. A., H. M., G. S., T. W., W. W., Prof. B., J. D. (write to the Admiralty), B. C. (in our next), J. H. (in our next), R. C. (declined with thanks), W. P. B., J. C. is referred to a description of Frier's propellers in this No. of the M.M., M. R. C. (too long and diffuse for insertion).

Errata.—In the paragraph at the bottom of the third column, page 140, of last number, read *Miss Burdett Coutts* for Messrs. Burdell.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

HOLYHEAD HARBOUR.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Spring Gardens, 3rd March, 1862.

Sir John Rennie presents his compliments to the Editor of the Mechanic's Magazine, and will feel much obliged by the insertion of the accompanying latter from Lord Clarence Paget upon Holyhead Harbour.

[COPY]

Admiralty, 24th February, 1862.

Sir,—In answer to your letter of the 22nd inst., I beg to express my regret that in some remarks which I made in the House of Commons I should have inadvertently connected the name of your late father with the Holyhead Pier, and I am not surprised at your desire to rectify the error. Mr. Rendel (not Rennie) built the Holyhead Breakwater and devised a Pier, but his plan has been so much deviated from that his representatives will doubtless, like you, repudiate the present design. You are at liberty to make any use you please of this letter. I have the honour, to be, Sir,

Your obedient servant,

C. Paget.

To Sir John Rennie, F.R.S., F.S.A., &c., &c.,

◆

THE REDUCTION IN OUR ARMAMENTS.

Sir,—Many questions having been put to the secretary of the navy, in the House of Commons, on the subject of the reduction in the number of guns and men on board the Emerald, Shannon &c., and the answers returned being eminently more diplomatic than satisfactory, I venture to adduce what I hope will be a satisfactory reason; being unlike the official personage alluded to above, neither fettered nor restrained by any official position.

It may be remembered that in the lecture I delivered at the United Service Institution, on the screw fleets of England and France, and which you noticed in your columns, I was the first, who, in England, drew attention to the faulty principle of armament carried out in first-class French frigates, whether converted or otherwise. A full year after, I had the satisfaction of having my commentaries endorsed by the Capitaine de Vaisseau, the Viscomte de Kerveguen, and also by Mons. Arman, the celebrated shipbuilder at Bordeaux, both pointing out the great error of piercing the side of the large frigates for too many guns, the Impératrice Eugénie, and others which I had myself adduced, being brought forward as cases in point.

I have reason to believe that these gentlemen's criticisms, the interpreters of the French naval service in the legislative assembly, made a great impression on the Minister of Marine, for I noticed that soon after, the Guerriere, the Pallas, and the Circé, were ordered to be so far altered that from having had 23 ports on the broadside, like the Impératrice, only 8 feet apart, they made their appearance in commission with just half the number, a change easily effected by condemning and filling up every alternate port. This step being immediately reported to our late excellent controller of the navy, a like reduction of ports was ordered in the frigates now laid down, and a new class, the Dartmouth, at Woolwich, the Endymion, at Deptford, and the Ister, at Devonport, all designed as 36 gun frigates, of 2,478 tons, made their appearance. The reduction of armament in the French service being favourably entertained by the officers in command, who gladly saw their ships delivered of so much top-hamper which they could hardly bear, was ordered to be further carried out in all first class frigates already in commission, and one and all immediately returned some 14 or 16 guns into stores. The last new model, the beautiful Hermione, the crack frigate of the French navy, and a very near assimilation of our own Immortalité and Glasgow, now mounts 28 guns, each of these being, unlike any yet seen in French ships, no less than 18 feet apart.

It will appear obvious to your readers that this change being accepted as final in the French service, and as we must, as I intimated in my lecture, of necessity regulate our armaments by the French ratings, our Admiralty were probably but too happy to follow the initiative, and adopt a measure which, while it no longer militated against their efficiency as ships of war, relieved our frigates from an excess of guns, and a proportionate weight of stores and men, which became in bad weather so many powerful levers to destroy the otherwise delicate fabric of the screw ship. I am, sir, yours faithfully,

C. L. Pickering, Assoc. Inst. N. A.

Wellington-square, Chelsea.

◆

LONG RANGE RIFLE SIGHT.

Sir,—In these days of rifle practice, most of your readers will be aware of the difficulty which has existed at the longer ranges in getting a view of the object over the long hind-sight which then becomes necessary—at the same time keeping the position which can alone secure accurate shooting. Either the head must be unduly raised, or the butt of the rifle brought under the arm, instead of to the shoulder.

In either of these cases, the recoil destroys all chance of steady practice.

To obviate this, I have applied to the hind-sight a prism of glass, which reflects the image of the target, as also that of the muzzle, in contact, at whatever range, to the eye of the shooter, when in the correct position, as taught at Hythe.

This invention has been carried out, and will be shown to any one who is interested in the matter, by Mr. Daw, of Threadneedle-street, the celebrated gunmaker, who has so well put into practice all the very great improvements originally devised by the late General Jacob, and who has given lately to sportsmen one of the most perfect breech-loaders ever invented for sporting purposes. Yours, &c.,

J. H. Selwyn, Capt. R.N.

◆

STEERING SHIPS OF WAR.

Sir,—Mr. Scott Russell, at the last meeting of the I. N. A. said, "our naval friend asks for a ship that will be as handy as a boat, and as quick as a cutter, and refuses you breadth of rudder, and length of tiller, or turns of the wheel, to give you sufficient purchase;" and this is the fact. In former years, one twentieth of the "length between perpendiculars," was considered the proper breadth of rudder, but now there are steam vessels fitted with rudders one-sixtieth only in breadth, or one third of the proper size according to the old practice. Of course the reason for this gradual diminution in breadth is obvious. The swift steam vessel of the present day draws less water than the old fashioned tub. She is three times as long, and according to the old rule would require a rudder of proportionate breadth. But a rudder of three times the breadth requires to be nine times the strength, and the swift steam vessel is not able to bear this strain upon her dead-wood, and therefore the rudder is reduced in size, and consequently, in efficiency also. I think the minimum size has now been attained, and that we must increase the breadth and strength of rudders, if they are not going to be superseded by something more efficient; as we can do almost anything with iron, they can readily be improved in strength, form, and efficiency; and I do not expect to see the rudder superseded in my time.

Digitized by Google

In Saturday's *Times* there is an interesting account of the trial trip of the "Defence." She exhibited a peculiarity which I have not heard of before, but which I think arises from her rudder being too small. When going full speed she kept on her straight course for some minutes after the helm was put over, and when once she began to obey her helm she went rapidly round. This inherent power in the moving mass to overcome the action of the rudder is analogous to the action of the well known gyroscope top. The vessel, being in rapid motion, requires a full sized rudder to suddenly alter the direction of that motion, but when once altered, a much smaller rudder would be equal to the continuance of the steering process.

The action of the rudder on the water is not what it is intended to be in ships without a screw-propeller; a dead mass of water is carried forward in the angle formed by the rudder and dead-wood, and the water impinging against this moves in a curve formed by itself, and a quantity of eddy is drawn after the vessel on the other side of the rudder round which the water flows in another curve. This proves that water cannot be made to turn a corner. The after stern-post of screw steamers also very much impairs the proper action of the rudder.

To remedy these defects, I should make the rudder very strong, hang it in a very firm manner by the head and heel only, and give the middle portion such a form that it would be several feet away from the after stean-post, so that when acting it would have more leverage on the vessel, and there could not be any dead water on either side of it. As the authorities are doing away with "well holes" in our iron-sided ships, there is no reason why the rudder-head should not enter the vessel below the water-line, for greater security from shot. I am Sir,

Yours very obediently,
T. Moy.

1 Clifford's Inn, 3rd March, 1862.

◆

CONTROLLABLE IRON WARRIORS.

February 25th, 1862.

Sir,—When the Great Eastern returned in September last, with disabled rudder and paddles, I suggested through the public press that such large steam vessels should have two propelling screws placed one on each side of the rudder half way between it and the respective stern quarters, dispensing entirely with the present centre screw. Thereby the modified action of the lee screw would bring up and keep a ship's head to tha wind. The engineman below with a compass before him could by judiciously working the engines fast and slow, steer a vessel correctly any desired course, thus saving vessels from being driven ashore as in the case of the Royal Charter, and reducing considerably in a year the casualties of the steam marine.

Such arrangements appear especially applicable for iron war steamers, which are liable to become unmanageable when at sea in bad weather, and their rudders may become disabled when encountering other ships and forts.

Two shot proof cylindrical casings protruding from the stern of a steamer one for each screw with their lower parts and ends open for the admission, play, and outlet of the water. Thus our iron ships would be controllable in adverse circumstances.

Yours truly,
George Walcott, C.E.

◆

DISCUSSION ON GUNPOWDER.

Sir,—In the 142nd page of your Magazine, of 28th of Feb. last, there is a paper headed "Discussion on Gunpowder," in which there are gross mistakes. In the first place Professor Bunsen must have had very inferior gunpowder to experiment with, if as he states that he found 67·7 per cent. of the *solid residue* on the combustion of it, and only 31·24 of *gaseous product*; the usual proportions with *good gunpowder* being nearly equal, but always rather in excess in the proportion of solid residue.

As to the analysis, it is *perfectly useless*, not only under the supposition that his gunpowder was inferior, but from his own statement of the analysis of the gunpowder he used, viz.,

Nitrate of Potash	79·99
Sulphur	9·84
Carbon	6·69
Hydrogen !	·41
Oxygen !	3·07
	100·00

I will undertake to say that no *serviceable* gunpowder ever made had so small a proportion as 6·69 per cent. of carbon in the proportions of the ingredients, and what the Professor means by having found *free oxygen* and *hydrogen* in the composition I cannot comprehend!

Professor Seely's remark, therefore, that "Bunsen's analyses are exceedingly interesting and instructive," is quite ludicrous to those who know anything about gunpowder.

I am, Sir, your obedient servant,
Samuel Parlby.
Brevet Lieutenant Colonel, late Bengal Artillery,

Percy Street, Bedford Square, 5th March.

◆

TELEGRAPH TO AMERICA

North Atlantic Telegraph,
Temporary Offices, 61 Moorgate Street, London, E.C.
March 5th, 1862.

Sir,—The Secretary of the Atlantic Telegraph Company, says, in reply to my letter, that the line of submarine telegraph between Malta and Alexandria is 1535 miles long, but he is in error as to the length, which even in statute miles, falls short of his figures.

Submarine cables are commonly reckoned in nautical miles, or knots, and estimates and contracts for their manufacture are generally so computed; I therefore adopted the usual system in my figures. I find that the exact distance of the line is 1318 marine miles and 1412 yards, according to Messrs. Glass and Elliot's tables under date of 17th ultimo; but Mr. Saward makes it 1535 miles. He appends a letter stating that the writers are prepared, *if a line 2100 miles long could be laid and maintained in the condition as manufactured by them*, to guarantee its efficient and satisfactory working, but they do not say at what *rate* of working! and the condition reserved is ominously important. Does Mr. Saward (or any others interested in the old route, where so much capital was lost) mean to deny that the working of a cable is reduced in speed as the *square of the length of the line?* and how can he get over the fact that the Malta and Alexandria line can only be worked through direct between those points, at a speed of between three and four words per minute, while eight to ten words per minute can be got through by dividing it into sections. Whether the line was broken into sections, in order to open up the commerce of Benghazi and Trepoli, by supplying them with telegraphic facilities, or not, is best known to the Government, but I am inclined to think that *speed* of transmission had something to do with it.

The matter at issue is simply whether a line divided into sections, as proposed on the Northern route, would work quicker than by the long circuit from Ireland to Newfoundland, and whether, to produce equal electrical results, the cost of the conductor, and insulating material of the long line, must not be enormously and uselessly expensive.

The Government will no doubt submit any offer made to it, to an independent and well qualified committee, before giving any guarantee, or spending any money in connection with a project which has been already experimented upon so disastrously; and I doubt not, but that the result of such an investigation will be the adoption of the northern route.

The distance between Ireland and Newfoundland is about 1640 marine miles, and from Scotland to America, via Greenland, it is about 1645 miles. From London to Quebec, by the Northern route, the distance will be less than by Newfoundland.

There are manufacturers ready to contract for the laying and working of the Northern line, for a less sum than will be necessary to lay a line on the old route. Supposing the expenses are equal, what will be the *rate* of transmission? I say that by the Northern line, it will be *nine times* greater than possible by the long line from Ireland to Newfoundland.

I disclaim any intentional disrespect to the old Atlantic Telegraph. Those interested in that unfortunate enterprise sacrificed an immense sum of money, with the hope of attaining a great end. A like result can be avoided by the adoption of the Northern route.

Yours very respectfully,
Tal. P. Shaffner.

◆

GASES AND "EVIL SPIRITS" IN COAL MINES.

Sir,—The subject of gas in mines and collieries, is a very important one; and I agree with your suggestion that miners should be trained to contend with them as their natural enemies. The word cobalt—for that metal comes from the German word signifying an evil spirit or enemy (kobola); it is one of the noble metals believed to be spoiled by an evil spirit in the mine; this mythical evil spirit has been working much mischief of late in another form: witness the fifty dead bodies now lying after a coroner's inquest at Merthyr Tydvil, and the previous horrors of the New Hartley accident; all these miserable deaths are owing to the noxious action of certain gases. Dr. Headlam Greenhow, who has been appointed by Government to enquire into the whole subject of gaseous emanations in collieries, tells me this week that carbonic acid gas is given out in quantities by the shales of some mines, but he was scarcely prepared for the fact that this gas has been recently shown to be as respirable as chloroform vapour; it is in fact now used very much by inhalation to cure irritable cough, and does not kill, as popularly believed. The great poison of mines—the deadly "stythe" of the New Hartley colliery, an unsuspected poison, as deadly as prussic acid—is carbonic *oxide*, from the furnaces in the mines, but which might be removed possibly by an ordinary chimney, and for which certainly lime as now used is no antidote whatever. These facts have been only recently made out in a very full examination of all these gases on animals, and a comparison of their effects, with the effect of the vapour of chloroform, ether, &c., all undertaken by the Academy in France. The accident at Merthyr Tydvil is, of course, the old one of the "evil spirit" of carelessness, of carburetted hydrogen collecting, whilst the poor men were at dinner in another place in the mine; ventilation and Davy lamps neglected, and the usual precautions not taken to prevent the mischief of this easily-obviated explosion.

Yours, &c.,
Charles Kidd, M.D.

P.S.—Gold and silver are the kings of the kingdom of metals, in the old fancy of old chemists; but what are known as "*reguli*," or little kings, are antimony, iron, &c. The cobalt—so goes the legend, is an uncrowned monarch, very like gold, but more like copper—destroyed by the pixies and fairies, all which is rather quaint. But what if our Newcastle coals should soon suggest ideas of a like kind, and take their place alongside cobalt, with many melancholy recollections of the work of the "evil spirits" of bad ventilation, or carelessness—the good genius of Parliament should prevent this.

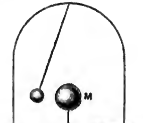
Sackville-street, February 23.

◆

SELF-MOVING MACHINERY.

Sir,—I have always, I believe, shewn that self-moving machinery cannot be contrived, and would now point out how the most perfect approximation to it—motion, circular or elliptical, for a very long period—can be brought about.

A spherical magnet *m* should, upon the top of a short rod fixed vertically, be adjusted over the centre of a large metallic plate, as that of an air pump; or it should thus be fixed near the centre of a large air-pump plate, and the plate should have a receiver, from the centre of the top of which, by means of a very fine silken thread, a smaller spherical ball of steel should be suspended, which thread should be sufficiently long to allow a line drawn through the centres of the balls to be a horizontal one. A contrivance for moving the smaller and unfixed ball in any direction, and with various degrees of face, which could be withdrawn, to prevent further interference, should be effected, and, fixed inside the plate, be connected with its outside in an air-tight manner; and previous to working it a more or less perfect vacuum should be produced, which being effected, the ball should be impelled with such force, according to its distance from the magnet, that it would move in some circular or elliptical orbit, the size of which would continually become smaller, the ball at some time, on account of the resistance of the remaining air and the friction of the thread, striking the magnet. Thus can motion for an indefinite period be produced, which is something for those who who still strain after the *perpetuum mobile*.



Many have heard of so called "perpetual" lamps, and of

> "The bright lamp that lay in Kildare's holy fane,
> And burned through long ages of darkness and storm!"

But the accounts which we have are too dubious to allow of any scientific deductions being founded on fact.

Now, as regards constancy of flame, I may observe, that this could be brought about were it possible to decompose water by means of a magnet, that is, supposing the magnet maintained a sufficient degree of power, which would, I think, be the case. Thus the water consequent upon the combustion of the hydrogen could be freed from its hydrogen, which might readily be conducted to the place of ignition; and similarly, every combustible substance, both solid and fluid, could be reproduced, its several constituents being disunited from their conditions of union.

I am, sir, yours, &c.,

J. Alexander Davies.

Feb. 25, 1862.

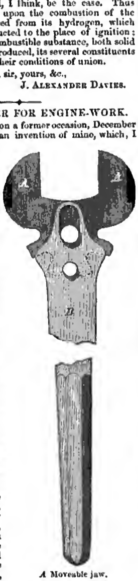
◆

A NEW SPANNER FOR ENGINE-WORK.

Sir,—Your having on a former occasion, December 27th, kindly inserted an invention of mine, which, I am glad to say, is now in a fair way of being practically proved—the form, but not the principle, of the expanding-ring shot having since been altered from an elongate to a sphere;—has influenced me to send a drawing of a new spanner for engine-work, invented by me, and one of which has been made and tried with perfect success, and which is adapted for positions in which no existing wrench can be applied, as well as for general use.

The jaws can be placed either in a direct line with the handle, as in the drawing, or at four different angles therefrom, and the intelligent mechanic will see at a glance numerous instances in which it could be used with advantage.

The principal use, however, for which it was designed is the partial rack motion, by which an ordinary hexagon, or other nut, can be turned within one-third the space necessarily required by the handle of the common spanner, greatly facilitating work on board ship, and other places where space is generally contracted.



A Moveable jaw.
B Moveable handle.

I remain, sir, yours obediently,

W. H. Eveleigh.

14 Rectory Grove, Woolwich, Feb. 17, 1862.

◆

BLASTING ROCK.

Sir,—As you have quoted in your paper of this date the information given in a recent work of mine on blasting rock, it seems to me desirable that you should also insert a reference to the authorities I have cited, viz.:—

General Sir J. T. Burgoyne "On Blasting and Quarrying."

Mr. William Sim "On the Quarrying and Blasting of Rocks," read to the British Association in 1855.

Mr. George Robertson, C.E., "On the Large Blasts at Holyhead," read to the Royal Scottish Society of Arts.

I am, Sir, your obedient servant,

W. J. Macquorn Rankine.

Glasgow, March 1, 1862.

The half-yearly meeting of the shareholders in the Submarine Telegraph Company, was held on Tuesday last, Sir James Carmichael presiding. The directors reported that the receipts for the last six months had reached the sum of £17,119 14s. 8d., which is an increase of £2,084 6s. 1d. over those of the previous six months. The decrease of receipts which had been caused by the reduction of charges had been almost balanced by a large addition of traffic.

MEETINGS FOR THE WEEK.

Mon.—*Medical Soc.*, Clinical Discussion at 8.30 p.m.
Royal Geographical Soc., I. "Travels in Cambodia," by M. H. Mouhot. II. "Tour to Karen-ni, through the Shan States to Tuogu," by Edward O'Riley, Esq. III. "The N.W. Coast of Borneo," by Spenser St. John, F.R.G.S., late Consul-General for Borneo, at 8.30 p.m.
London Inst., "On the Instrumental Music of the Opera, &c.," by J. Pittman, Esq., at 7 p.m.

Tues.—*Inst. Civil Engineers*, "On Certain Works recently executed at the Sulina Mouth of the Danube," by C. A. Hartley, Esq., at 8 p.m.
Royal Inst., "On Sight, and the Special Organs of Hearing in Man and Animals," by J. Marshall, Esq., at 3 p.m.
Zoological Soc., at 9 p.m.

Wed.—*Society of Arts*, "The Mauritius: Its Commercial and Social Bearings," by James Morris, Esq., at 8 p.m.
Geological Soc., I. "On the Glacial Origin of certain Lakes in Switzerland, Wales, Scotland, and elsewhere," by Prof. A. C. Ramsay. II. "On the Permian Beds of Westmoreland, Cumberland, and Dumfriesshire," by Prof. R. Harkness.

Thur.—*Royal Soc.*, at 8.30 p.m.
Soc. for the Encouragement of the Fine Arts, "On the Patrons of Art," by F. Y. Hurlstone, Esq., at 8 p.m.
Royal Inst., "On Heat," by John Tyndall, Esq., at 3 p.m.
Antiquaries, at 8.30 p.m.

Fri.—*London Inst.*, "On the Classification, Properties, and Uses of Plants," by Robert Bentley, Esq., at 7 p.m.
United Service Inst., "Geodesy, especially relating to the Great Trigonometrical Survey of India," by Major Strange, at 3 p.m.
Royal Inst., "On Motion in Plants and Animals," by W. S. Savery, Esq., at 9 p.m.

Gossip.

Colonel Shaffner has published in this country, through Hamilton, Adams, and Co., a book on the war in America, being an historical and political account of the Southern and Northern States, showing the origin and causes of the present secession war. The book contains a considerable amount of information, which will be found particularly valuable at the present time. The author, though a southerner, is not a secessionist. He concludes his preface by saying: "The South ought not and cannot be subjugated by the cannon. A twig from the olive branch, ever full of eloquence, is the only thing that can conquer it." And he concludes the book by saying: "The American people can only live as *one* nation, though there is territory enough for a dozen. In this judgement, however, we may be biased, because it comports with our wish. "United we stand; divided we fall."

Some further trials, says the *Times*, were made at Chatham on Friday night last, with Captain Bolton's newly invented telegraphic lime light signals, in order to put the invention to a more extended test than on the occasion of the previous trial. On this occasion three parties of telegraphists were engaged, each provided with the lime light together with the small portable apparatus invented by Captain Bolton for generating the oxygen and hydrogen gases which produce the light. One party was stationed on the commanding elevation known as Blue Bell-hill, near Maidstone; a second being placed on the banks of the Thames, nearly opposite Southend, at a distance of 12 miles in a straight line from the first party; Captain Bolton again occupied the Spur battery, from which, with a party of Royal Engineers, he superintended the signals. The night was clear. Notwithstanding the great distances the light shone out with remarkable brilliancy, enabling the three parties to keep up an uninterrupted communication with each other. The most valuable part of Captain Bolton's invention is that a hazy or thick atmosphere does not interfere with the working of the signals, as by a modification of the lenses used, a light sufficiently powerful to pierce through a thick fog can be produced. During the present week the invention will be tested at still greater distances, the parties being stationed twenty miles from each other.

The trial of small-bore Rifles at Woolwich, during the last fortnight, does not appear to have been attended by the most decisive results, and we imagine that further testings of the various and excellent weapons used thereat, will have to be made before just opinions as to their respective merits will be found. The authorities who preside at their trials must be like Caesar's wife, "not only free from guilt," but beyond suspicion of impurity. In saying this we by no means wish to insinuate that anything but fair play was dealt out to the competitors, but the fact that some of the latter thought and said so, weakens the general conclusion of the umpires.

The remarks of the Mechanics' Magazine of Friday last in reference to the steering of ships of war, were corroborated to an extraordinary extent by the *Times* of the following day. The latter journal then gave an elaborate and technical account of the trial of the new iron-plated ship Defence, at Spithead, or rather in the Solent, on the 28th ult. The Defence is a vessel of 600 H.P. (nominal), of 3,668 tons, and she mounts 18 guns. Her outward appearance is described as being anything but prepossessing, but as she was never intended to be ornamental this is a failing which may be overlooked. Her bad behaviour on the occasion of her official trial trip on Friday last is a matter of far more serious consequence than her having a very forbidding profile. On the morning in question the Defence, we are told, steamed out of Portsmouth Harbour at 9·45 under half steam, and found at Spithead a stiff breeze blowing from E.N.E. Under pressure of the latter, after some consultation on board, the trial was commenced and completed. Six runs at the measured mile in Stoke's bay were made with the following results. 1st run.—Mean time 3 min. 45 sec.; speed in knots 12·543; revolution of engines 67½. 2nd run.—Mean time 6 min. 15 sec.; speed in knots 9·600; revolution of engines 65½. 3rd run.—Mean time 4 min. 33 sec.; speed in knots 13·186; revolution of engines 67·14. 4th run.—Mean time 6 min. 24 sec.; speed in knots 9·375; revolution of engines 67. 5th run.—Mean time 4 min. 25 sec.; speed in knots 9·375, revolution of engines 67. 6th run.—Mean time 6 min. 24 sec.; speed in knots 9.375; revolution of engines 68. First means:—11·071, 11·393, 11.282, 11·480, 11·479. Second means:—11·232, 11·338, 11·381, 11·480. True mean speed in knots 11·357. These figures are unquestionably of a satisfactory character, and the Messrs. Penn and Sons who constructed the engines have, by their production, added another leaf to their laurels. So far then, all had gone "merry as a marriage bell" with the Defence on her trial trip, but as every medal has a reverse, so, unhappily, is there another side of the picture in this case; and at the conclusion of the above, and other experiments, the ship's head was laid for the harbour, and in passing along the Channel, in line with Southsea beach, an accident (?) occurred which might have been attended with serious consequences. It had been observed with no small alarm that on the ship completing her fourth run at the mile and in taking a turn to the eastward she for some time *took no notice whatever of her helm* after being put hard over and *ran in dangerous vicinity to shoal water*; but just in time she came up to her helm and escaped most probably a disaster. Similar steering difficulties had to be encountered in "putting her at the circle." In entering the "harbour channel" the speed was slackened from "full" to "three-quarter" at about its narrowest part, when the ship's bow inclined towards the shore, and all the exertions of the pilot and the men at the wheel had no effect—*the ship's bow had taken the ground*; "astern full speed!" was the order instantly given, and off she came; but she had got so far on the shoals that of necessity *the stern next took the ground*, and for some time so hung. The head sails being now loosed and the engines put on full speed the ship was again relieved from her perilous position. In leaving the harbour for a second trial trip, on Wednesday last, the Defence again manifested great want of readiness in answering her helm. Her engines were reversed on one part of her course, to prevent her getting on the beach. The eight men at her wheel seemed to expend a great deal of muscular exertion without producing an alteration in the ship's course in the time allowed. The deficiency of steering control demonstrated in the brief trip of the Defence appears thus to be greater in extent than the same evil in the Warrior and other iron-clad vessels to which we have alluded. Surely, then, this last warning will be sufficient to induce the Admiralty to consider seriously the amount of responsibility which their supineness attaches to them in regard to the steering apparatus of our ships of war. We understand that the Black Prince, now fitting in Portsmouth Dockyard, is to be supplied with an *auxiliary* to the rudder in the shape of a hydraulic contrivance, but our own opinion is, that nothing short of a *substitute* for it will ever be found effective for screw steamships; the sooner, therefore, this is sought after the better.

At an evening meeting of the members of the United Service Institution, held last Monday, and at which the very important question of the fouling of Iron ships was ably discussed, Mr. Robert Mallet mentioned some curious facts in relation to shell-fish and their affinity for ship's bottoms. Experimenting upon oysters, he discovered that those denizens of the deep were prepared to absorb, without injury to themselves, any amount of metallic poison, provided only it were administered in small increments. Thus he had administered to oysters in periodically increasing doses, sulphate of copper until the water in which they existed became perfectly green, and a table-spoonful of it would prove fatal to the human being. Still the tenants of the shell-jackets lived on, and thus added another illustration to the adage, that "use is second nature." Next week we hope to touch upon the main points of the United Service Meeting.

Mr. Sauvageon, of Valence, has studied the different phenomena which are produced in a cup of coffee when the sugar is put into it, and the result of those observations transforms the demi-tasse into a barometer. "If, in sweetening your coffee," says M. Sauvageon, "you allow the sugar to dissolve without stirring the liquid, the globules of air contained in the sugar, will rise to the surface of the liquid. If these globules form a frothy mass, remaining in the centre of the cup, it is an indication of duration of fine weather; if, on the contrary, the froth forms a ring round the sides of the cup, it is a sign of heavy rain; variable weather is implied by the froth remaining stationary, but not exactly in the centre."

A sum of 200 guineas is offered by the National Association for the Relief of British Miners to any engineer or other person who projects and carries into effect the best and most effective plan for the full and perfect ventilation of mines.

The officials of the Chatham Dock-yard have received orders from the Admiralty to report on the number and description of models of modern ships, which can be forwarded to the International Exhibition.

The Solicitor-General's Bill for giving copyright in paintings, drawing, and photographs for the life of the author, and seven years after his death, imposes also a penalty upon any person (1) who shall fraudulently affix any name, initials, or monogram upon any work of fine art; or (2), who shall fraudulently offer for sale or exhibition any work of fine art, having thereon the name, initials, or monogram of a person who did not execute the work; or (3), who shall fraudulently dispose of any copy or colourable imitation of any work of fine art as having been executed by the author of the original work; or (4), who during the life of the author shall without his consent offer for sale any work of his (which has been disposed of by him), or copy thereof, altered by some other person, as the unaltered work of the author. A person disposing of a painting or drawing is not to retain the copyright unless it be reserved to him by express agreement in writing.

The British colonies generally appear to be vieing with each other in their contributions to the International Exhibition, and all things promise that they will be fully and fairly represented. A rather singular article is expected among others from Port Natal; it is in the shape of a large carved sideboard, made of all the furniture woods of the colony. It is ornamented with glazed panels, containing maps, meteorological tables, and photographs of scenes on the coast. Its shelves are to be loaded with samples of native produce. We shall also have from this same settlement a model of a South African waggon, some valuable specimens of food, cotton, wool, and wood. In all, the contribution will consist of 800 distinct articles, and it will be systematically divided into classes, comprising raw materials, mineral substances, specimens illustrative of the natural history of the colony, Kaffir medicines, and photographs of Zulu chiefs, who have been persuaded to sit to the camera.

The Paddle-wheel Steamer Reiver.—The hull and machinery were designed and constructed by Messrs. John Laird, Sons, and Co., and are most substantially built and equipped in every way for hard seagoing work. The following are the principal dimensions of the vessel and machinery:—Vessel: Length between perpendiculars, 302 feet; extreme length, 315 feet 9 inches; width between paddles, 31 feet; extreme width, 60 feet; depth in hold, 17 feet 8 inches: builder's measurement, 1,448[illegible] tons; gross register, 1,189[illegible] tons. Machinery: Diagonal engines, 412 horse-power; diameter of cylinder, 74 inches; length of stroke, 6 feet 6 inches; diameter of wheel (feathering) to outside of float, 29 feet; diameter to axis of float, 25 feet; number of floats on each wheel, 12. The boilers are fitted with apparatus for superheating the steam and heating the feed water. The cylinders have steam jackets, and they and the exposed parts of the boilers are lagged. There is a complete arrangement of surface condensers, in addition to the ordinary jet condenser, either of which can be worked at pleasure. In December several trials were made with about 100 tons weight on board, or in what may be considered light trim, and a speed of more than 16 knots was obtained, the engines making 24 revolutions per minute. Indicated horse-power 2500 to 2600. It was found that the same result was obtained with the surface condenser as with the ordinary jet condenser. During last month a series of trials were made to test the consumption of coal at various rates of speed, the vessel being loaded with about 450 tons dead weight. The following results were obtained with the ordinary condensers:—A speed of 12 knots with 28 tons 12 cwt. per day, or $2\frac{1}{2}$ lbs. per indicated horse-power per hour; 14 knots, with 51 tons per day, or $2\frac{1}{4}$ lbs. per hour; 15 knots, with 70 tons 6 cwt. per day, 3 lbs. per hour; and with the surface condenser a speed of 15 knots, with 66 tons 8 cwt. per day, or $2\frac{1}{10}$ lbs. per indicated horse-power per hour. The coal used was Powell's Duffryn steam coal, which was taken direct from the bunkers, and not picked. The weather, during all these trials, was unfavourable. When the size of the vessel, the weight on board, and the speed are taken into account, these preformances must be considered most satisfactory; and we have no doubt that the vessel will prove herself a clipper when fairly at work on her station. The Reiver is for Messrs. Jardine, Matheson, and Co., and is intended to trade in Chinese waters.—*Liverpool Albion.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2017, 2041, 2050.
Boilers and their Furnaces, &c., *None.*
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2031.
Ships and Boats, including their fittings, 2018, 2028.
Cultivation of the Soil, including agricultural and horticultural implements and machines, *None.*
Food and Beverages, including apparatus for preparing food for men and animals, 2051.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2011, 2015, 2016, 2019, 2022, 2030, 2039, 2043, 2044, 2046, 2047, 2052.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2021, 2034, 2045, 2049.
Lighting, Heating, and Ventilating, 2026, 2029.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2012, 2014, 2036, 2038, 2040, 2048.
Metals, including apparatus for their manufacture, 2020, 2023, 2024.
Chemistry and Photography, 2013.
Electrical Apparatus, *None.*
Warfare, 2013, 2042.
Letter-Press Printing, &c., *None.*
Miscellaneous, 2009, 2010, 2035, 2037.

2009. J. Jacob. *Improvements in producing on porcelain and other ceramic products, on glass, venetian enamels and on metallic surfaces, designs in colours and in gold, silver, and other metals.* (A communication.) Dated August 13, 1861.

According to this invention such designs are first printed on paper in the lithographic press, and thereupon drawn off or transferred upon the article or object to be ornamented, as is usual in chromo-lithographic or colour printing; the various colours and metals are printed on to the paper in succession, each from a separate stone, the paper used for this purpose being prepared to prevent shrinking during the operation of printing and transfering the design upon the object to be ornamented. The prepared metals and prepared colours as well as the vitreous mass or flux, are in all cases reduced to the finest powder or dust before being used. On ceramic products and on enamels the ornamentation can be produced either upon the glaze or under the glaze. *Patent completed.*

2010. J. Lancaster. *A new method of producing sand.* Dated August 13, 1861.

Here the inventor places the stone ballast or gravel in a suitable machine for crushing, pulverizing, and washing the same, after which it is to be passed through sieves of various sized meshes according to the purpose for which it is required. *Patent abandoned.*

2011. S. Andrew and S. Hornby. *Improvements in machinery, or apparatus for opening, cleaning, and preparing cotton and other fibrous materials.* Dated August 13, 1861.

This invention is carried into effect as follows:—1. The patentees employ one or more large cylinders, and adapt them for up and down draughts by giving them a reverse motion to that hitherto used, so that they strike downwards instead of upwards, by which means they obtain a larger and improved surface of grate bars in connection with a perforated plate, or sieve, in a diagonal position for extracting the dirt and refuse matter. 2. They employ two, or more wire, or perforated metal cylinders, or cages for exhausting dust, or light leafy substances. 3. They adapt a side shaft for driving the feeder and delivery rollers by bands or gearing, and cause the machine to deliver the opened and cleaned material at the opposite end to the feeder, instead of delivering underneath it. 4. They apply the aforesaid large cylinders to lap machines having one or more beaters. *Patent completed.*

2012. J. G. Remy. *Improvements in the manufacture of articles of furniture, by utilizing certain parts of the cedar tree in such manufacture, which have hitherto been considered and treated as waste.* Dated August 13, 1861.

Here the patentee saws the waste pieces of the cedar tree into veneers, glues them together, and polishes the same. *Patent completed.*

2013. C. Binks. *Improved methods of, and apparatus for treating linseed and other oils and fat.* Dated August 13, 1861.

The specification of this invention is to voluminous to be quoted here in detail. The objects of the invention are as follows:—1. To improve the drying properties of linseed and other oils. 2. To obtain such drying oils in certain cases free, or comparatively so, from colour. 3. To provide methods of obtaining dark coloured drying oils, similar to those known as boiled oils. 4. To impart to such oils, at pleasure, different degrees of thickness, or "body." 5. To provide methods of operating, and improved apparatus by which these effects can be obtained, or for bleaching, or refining linseed and other oils and fats. *Patent abandoned.*

2014. N. Common. *Improvements in apparatus applicable to water-closets and urinals.* Dated Aug. 13, 1861.

Here the inventor uses an air-tight vessel in which water sufficient for one discharge is collected as the water accumulates, air contained in the vessel is compressed, so that when the discharge takes place the water will rush out with a force due to the degree of compression of the confined air. We cannot here give space to the details of the invention. *Patent abandoned.*

2015. B. Cooper. *Improved machinery for spinning and doubling fibrous materials.* Dated Aug. 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2016. W. Robertson. *Certain improvements in machines for preparing to be spun cotton, and other fibrous materials.* Dated August 14, 1861.

In carding engines a comb, having a reciprocating motion, is usually employed for stripping the fleece or sliver from the doffer. Instead of this reciprocating comb, the inventor places a central shaft parallel with the doffer, and at each end of it beyond the ends of the doffer he places a plate made susceptible of receiving a series of shafts, solid or hollow, capable of receiving a small amount of motion. On each of these shafts is placed a doffing comb to correspond in position with, and adjusted to take the sliver from the surface of the doffer. To effect the regulation of these combs, on the end of each comb shaft is placed a small arm having a projecting stud working in a groove of irregular form, fastened on the bracket in which the central shaft is made to revolve. The groove is adjusted so as to bring the combs into position for stripping the doffer, and instantaneously to withdraw them from contact with the fleece, whilst it remains in partial contact with the doffer. *Patent abandoned.*

2017. E. A. Rippingille. *Certain improvements in steam engines.* Dated Aug. 14, 1861.

This consists in a method of constructing steam-engines, whereby the power of the injection water as it is forced by the atmospheric pressure into the condenser is utilized. The invention is applicable to all jet condensing engines. *Patent completed.*

2018. N. Cox. *Improvements in the construction of iron ships, the said improvements relating to the method of attaching or securing bulkheads to the frame or ribs thereof.* Dated Aug. 14, 1861.

In order to strengthen the frame and shell of the ship where the bulkheads are fixed, the inventor proposes to add two, three, or four, additional frames, placed in front of the others, and rivetted to them, so that the frame forms as it were a vertical hollow beam with one side removed; to these compound frames he affixes plates in a similar way to those forming the sheathing on the outside; the side of the ship at that part will now be a hollow box of great strength. To the inner plates he fixes another angle frame or rib, and to this in the usual way he rivets the bulkheads. *Patent abandoned.*

2019. W. E. Gedge. *Improvements in pressing cloth and other fabrics.* (A communication.) Dated August 14, 1881.

Here the pressing boards are made good conductors of heat by metallizing them in any manner. *Patent abandoned.*

2020. F. Durand. *Improvements in the manufacture of metallic tubes.* Dated August 14, 1861.

This relates to a new mode of manufacturing any description of metallic tubes without brazing or soldering, and consists in casting the tube in a mould provided in the inside with a core arranged in such manner that, in running the molten metal in the mould, free escape is allowed to the air contained in the latter. *Patent completed.*

2021. A. A. R. Damoiseau. *An improved construction of kiln for baking bricks, tiles, or other similar articles.* Dated Aug. 14, 1861.

This consists, principally, in arranging the kiln so that all or a part of the feed-air is properly heated on reaching the fuel, so as to obtain a better combustion of this latter, and whilst, at the same time, the construction of the kiln allows of the articles being more equally heated or fired than was the case in the kilns hitherto made use of. *Patent abandoned.*

2022. G. J. Wainwright. *Improvements in certain parts of machinery or apparatus used in preparing and spinning cotton or other fibrous materials.* Dated August 14, 1861.

This relates to spindles used in mules for spinning, and in steps used both for preparing and spinning. On the spindles of mules and other machines, and such spindles as are not connected with a lift, the inventor places a bush, either fast or loose, made of cast iron. The spindles themselves may be enlarged in the part working in the bolster, or the bolsters may be grooved or hollowed, the objects being mainly a saving in oil and protection to the spindle. To the steps used in moles, frames, &c., for preparing the fibrous material he places a cover or list of any convenient shape so as to be free from the spindle, in order to keep out dirt, and confine the oil. *Patent abandoned.*

2023. R. A. Brooman. *Improvements in coating wire with copper, silver, gold, or other metal or alloy, in order to prevent oxidation.* (A communication.) Dated Aug. 14, 1861.

The object of this invention is to prevent rust or oxidation of wire, and the invention consists in coating the wire with copper, silver, gold, brass, tin, or other suitable metal or alloy, in manner hereafter described. The wire to be coated is first passed over a roller or pulley, which is in connection with the positive pole of a galvanic battery; then under one or more rollers or pulleys immersed in a bath or solution suitably prepared, and in which a piece of copper or other metal, which is to form the coat, is suspended by a platinum wire; this piece of copper being connected with the negative pole of the battery, the wire in passing through the bath or solution receives a deposit or coating of copper; it then passes over a wooden roller or pulley outside the bath and through a vessel containing water, on emerging from which it is cleaned and dried by a cloth or otherwise, and then wound on a roller, to be used as required. The bath or solution before mentioned is prepared according to the metal or alloy with which the wire is to be coated. *Patent abandoned.*

2024. E. Edwards. *Improvements in machinery, or apparatus for separating mineral ores, coal, and other substances from impurities.* Dated August 14, 1861.

This consists, 1, in the novel combination of the several parts of the machines described for washing mineral and other substances. 2. The novel application of flexible discs worked by revolving cams as described. 3. The combination with such flexible discs and moveable cams, where employed, of wheels, or rollers carrying scrapers, so that the said scrapers can be turned up out of the way for the purpose of cleansing the screens without stopping the machine. 4. The arrangement of such flexible discs, cams, and scrapers so that the same water can be used for a considerable time in performing the duty for which it is required, instead of permitting it to escape continuously. *Patent completed.*

2025. T. Silvester. *Improvements in spring balances, or weighing apparatus.* Dated August 14, 1861.

This consists in attaching the spring (in the description of balances known as "Salter's balances,") to the bottom instead of the top of the middle piece, or slide, by which a saving of about a third of the material is effected with the same size, or weight of spring; and instead of employing varnish, as heretofore, to preserve the barrels from rust, the patentee galvanizes the barrels, and also the middle pieces. In the ordinary balances the spring is always concealed, whether in use or not; in this improved balance, a short length of the spring is always to be seen protruding from the bottom of the barrel, and when the whole weight is on, about half the length of the spring is in sight, so that the existence of rust or damage to the spring is very readily ascertained, and lubricating matter is easily applied. *Patent completed.*

2026. W. Wilds. *Improvements in apparatus for ventilating.* Dated August 14, 1861.

This apparatus consists of a box, or case, the bottom of which is formed of woven wire, or perforated metal, and at top are fitted flaps, or lids, by which it is opened and closed, and which are connected by cords, chains, or like agents, passing over pulleys to a suspended balance weight. The patentee prefers, when he uses two flaps, or lids, to hinge, or joint them to a rail, bar, or style fixed across the box, and to support the pulleys over which pass the chain, or cords which are fastened to the flaps in standards fixed upon the rail, bar, or style, and to connect these chains, or cords to a chain, or cord, by which the balance weight is suspended. The apparatus is fixed at the ceiling, or the roof of the room, or place to be ventilated, in such manner that air may pass through it when open to, or from such room, or place, communication being provided between it and the atmosphere, which may be conveniently done, when the ventilator opens under another floor, by providing a grating, air brick, or opening at one, or both ends of the air trunk formed between the joists. By the balance weights the flaps, or lids may be completely closed, or may be opened more or less to admit and regulate the passage of air through the bottom of the box to, or from the room, or place to be ventilated. *Patent completed.*

2027. J. Billing. *Improvements in stoves.* Dated Aug. 14, 1861.

The patentee claims, 1, the construction of stoves wherein the smoke from the fire-box is caused to pass horizontally through an opening in the back of the stove into a central back flue, in which it descends, and then passes into two side flues, whence it ascends into the chimney as described. 2. The construction of stoves having ascending and descending back flues, or simply one ascending back flue and a sliding valve to regulate the opening into the same, in combination with a throat valve, or throat valves, and wherein the opening and closing of the throat valve, or valves, and of the sliding valve regulating the opening into the back flue, or flues, is effected by means of one and the same screw spindle and levers, as described. 3. The application of a rising and falling blower to stoves actuated by an escutcheon, or a rose, in conjunction with the knob that regulates the opening and closing of the valve, or valves, as described. 4. The construction of stoves wherein a second moveable grating is placed beneath, and is fitted in between the bars of the ordinary grating, for regulating the draught and clearing the bottom of the fire as described. 5. The construction of stoves provided with a back draught wherein a fire brick, or metal back is employed, having a number of vertical, or nearly vertical channels, through which air is made to pass, as described. *Patent completed.*

2028. A. Lebandy. *Improvements in towing vessels, or boats on rivers.* (A communication.) Dated Aug. 15, 1861.

This consists in laying an iron chain along the bed of a river to the extent to which it is required to tow vessels, which chain is made to pass up, on board a vessel acting as tug boat at one end of the same, where it is wound several times round a drum fixed on a shaft connected by suitable gearing to a steam engine fixed in the boat; after leaving the drum, the chain is made to pass along the deck to the other end of the boat, whence it again descends to the bed of the river; as the before-mentioned drum is caused to revolve by the motion of the steam engine, it winds up the chain in front of the tug boat, and lets it out again behind, the boat being thus caused to proceed in the direction in which the chain is being wound up. *Patent abandoned.*

2029. S. Carey and W. M. Pierce. *Improvements in apparatus for reburning animal charcoal.* Dated August 15, 1861.

This consists in making a revolving cylinder or retort for receiving the charcoal required to be re-burnt, of an octagon or other many-sided form, and casting or forming on each of the several longitudinal angles a bevilled fillet or rib, whereby the contents of the cylinder or retort, when in motion, may be readily agitated or spread, and more uniformly burnt than in the ordinary circular cylinder. The patentees also fit or hang the front end of the said cylinder or retort, or they sometimes hang or fit a door in or upon the front plate of the said cylinder or retort so as to facilitate the charging or discharging the contents. *Patent completed.*

2030. J. C. Rivett, J. Vickers, and S. Hayes. *Improvements in machinery and apparatus for spinning and doubling fibrous materials.* Dated August 15, 1861.

This consists in applying to the flyers or spindles of spinning and doubling machines a peculiarly-shaped boss, or head, furnished with one or more diagonal slots, which are enlarged, or otherwise shaped with the boss or head, to allow the yarn or thread to pass with ease to the leg of the flyer, by which it is wound on the bobbin in the usual way. By this means the guides between the rollers and the flyers are dispensed with. Another part consists in substituting cork for the usual flannel or cloth washers or strips, which are placed between the bottom of the bobbins and the bolster rail, for giving the requisite drag or friction to the bobbins. *Patent abandoned.*

2031. J. Bethell. *Improvements in the making of journals, axle-boxes, and bearing for machinery, axles, and spindles to work in smoking pipes, buttons, crucibles, and pots for chemical and smelting purposes, and also of a lubricating compound for railway and other carriages.* Dated August 15, 1861.

This consists in manufacturing from steatite the articles mentioned in the title. *Patent completed.*

2032. J. C. Martin. *An improvement in treating bones, and the manufacture of the products thereof.* Dated August 15, 1861.

This consists in treating bones with hydrochloric acid, applied to bones in succession, until the hydrochloric acid is saturated with earthy phosphates, and the obtaining phosphates or super-phosphates from such saturated solution by evaporation as described. *Patent completed.*

2033. P. Wesley and J. W. Wesley. *A new or improved elevating rifle sight.* Dated August 15, 1861.

This consists of a new elevating rifle sight, in which the slide is moved and the leaf or flap elevated by a rack and pinion. *Patent abandoned.*

2034. F. A. Kain. *An improved manufacture of artificial stone or earthenware, applicable for bricks, tiles, retorts, railway sleepers and other articles.* Dated August 15, 1861.

The inventor crushes to powder and sifts the small and refuse or other slate in combination with other materials, and also vitrifies the same in kilns at a high temperature. *Patent abandoned.*

2035. J. T. Hutchings. *An improvement in the construction of tennis and racket hoops with handle.* Dated August 15, 1861.

This consists, mainly, in the combination for such purposes of india-rubber, either by itself or in any of its various plastic compounds, or any other similar and suitable material. *Patent abandoned.*

2036. S. Desborough. *Improvements in the manufacture of umbrellas and parasols.* Dated August 15, 1861.

This relates to the metal ribs, stretchers, and joints of umbrella and parasol frames, and consists in forming the ribs and stretchers of metallic wire, the section of which is of T, triangular, bayonet, or other similar shape. The invention also consists in forming the metal ribs and stretchers of umbrellas and parasols of a double trough (‾|‾|‾|) or similar shape, or having two or more longitudinal channels. *Patent completed.*

2037. A. F. Menard. *Improvements in tanning, and in the apparatus employed therein.* (A communication.) Dated August 15, 1861.

This consists, 1, in the use of bark in bundles. 2. In the peculiar arrangement of the apparatus to be employed. 3. In the use of carbonic acid or other gas, whether the tanning is performed in a vacuum, by hydrostatic pressure, or by the old method. 4. In the mode of operating upon the skins in the vats by the injection of various gases combined with electric and galvanic currents. 5. In placing the skins in calcareous, magnesious, aluminous, silicious, or ferruginous solutions, in which are injected various gases, in combination with an electric and galvanic current for the formation of substances required in tanning. 6. In the mode described for constantly preserving the strength of the tanning solution at any temperature or condition of the atmosphere, and preventing the formation of gallic acid by means of carbonic acid. 7. In the application of carbonic acid and other compounds of carbon to form chemical compounds with the mineral substances described. 8. In rendering leather more pliable and more impermeable to water, by the saponification of fatty matters with sulphurite of carbon. *Patent completed.*

2038. C. W. Kesselmeyer and T. Mellodew. *Improvements in the manufacture of velvets and velveteens.* Dated August 15, 1861.

This invention is not intelligibly described apart from the drawings. *Patent completed.*

2039. J. Combe. *Improvements in machinery for hackling flax and other fibrous substances.* Dated August 15, 1861.

This invention cannot be described without reference to the drawings. The patentee claims, 1, stripping the tow off the hackles of steel hackling machines, by means of sheets of stripper bars, arranged and operated as described. 2. Causing the hackles to approach and recede from the flax holders of inclined sheet machines in the manner and for the purpose described. *Patent completed.*

2040. J. Fauchere. *An improved mode of manufacturing gold dials.* Dated August 15, 1861.

Here the inventor first produces an engraved plate of the dial intended to be reproduced, and from this by means of the electrotype process he prepares a matrix of copper. In this matrix he deposits any desired thickness of gold by the electrotype process, and the gold so obtained he mounts upon a backing plate of brass, fitted at its back with pins suitable for fixing the dial to the watch or clock frame. The gold electrotype copy he secures to the backing plate by means of solder; and in order to facilitate the process of soldering the dial to the brass backing plate he first submits the gold dial face to ebullition in water, taking care to change the water frequently; and in order to remove any cyanide of potassium which may still remain in excess, and thoroughly to clear out the pores of the gold, he immerses the dial in fluoric acid, and afterwards washes it in boiling water. It is then ready to receive at its back a deposit of copper, which will facilitate the soldering of the brass plate thereto. When the soldering has been effected, he covers the backing plate with a protecting coat of wax, and then immerses the whole in a bath of dilute nitric acid, by the action of which the upper matrix will be removed from the face of the gold dial plate. The dial may now be cleaned, cut, and finished in the ordinary way. *Patent abandoned.*

2041. R. D. Chatterton. *Improvements in transmitting motive power, especially applicable to piston propellers.* Dated August 15, 1861.

This invention consists in arranging round the periphery of a drum, one, two or more series of wedge-shaped projections, each of which series bears against and upon a friction roller, supported between or upon the cheeks or sides of a wheel in such manner as to cause the wheel to rock by the action of the wedge projections. When for transmitting power to piston propellers, that is, such propellers as effect the propulsion of the vessel by the direct action of the piston in the water, ropes, chains, or other like means of attachment are first made fast to each of the cheeks of the wheels; they are then carried under them, are passed through guides on the covers of the cylinders in which the propelling pistons work, and are turned back and secured to the cross heads of the piston rods. The power transmitted from and by the wedge-shaped projections on the main drum forces the pistons from the top to the bottom of the cylinder, while the return stroke is effected by the pressure of the water, aided, if need be, by springs. In this case from continuous rotatory, reciprocating motion is obtained. For the purpose of obtaining increased or multiplied velocity as compared with that of the main wedge drum, then instead of ropes or chains connecting rods may be employed for connecting the wheels carrying the friction rollers with cranks. When transmitting powder to piston propellers, the inventor finds it advisible to employ two sets of piston propellers, one set opening at or towards the stern, and the other set at or towards the bow, in order to move astern or ahead as required. And when using such two sets of piston propellers, instead of reversing the main wedge drum, he connects one set of friction wheels and propellers, and at the same time disconnects the opposite set, so that the vessel may be propelled forward or astern without stopping or interfering with the motion of the main wedge drum. *Patent abandoned.*

2042. T. Murcott and C. Hanson. *Improvements in breech-loading arms.* Dated August 15, 1861.

This invention applies to those guns, in which a charge chamber is fitted at the rear of the barrel, and consists in arrangements hereafter described for opening and wedging up the chamber, for the insertion of the charge into it, and for tightly and securely closing it prior to and at the discharge of the arm. Behind the chamber for holding the charge, the patentees cut a slot across the metal in a piece with the metal which forms the chamber; they then make a curved tail on the rear and lower end of the metal. To the stock under the chamber they hinge the front end of a lever, the rear end of which, when the breech is closed, lies and is held by a catch against the trigger-guard. Between the front of this lever and the trigger-guard there is hinged a vertical wedge. Upon the lever being brought down, that is in a direction away from the trigger-guards, it takes hold of the curved tail of the charge chamber, causes it to play upon the stud or bolt passed through the slot, disengages the chamber from the rear of the barrel, and causes it to tilt upwards at front to receive a charge. On the lever being returned to the trigger-guard, the vertical wedge causes the nose of the chamber to descend, drives it forward into the rear of the barrel, and rises to wedge and hold the whole chamber securely in its place; the back of the wedge abuts against the rear of the chamber frame. *Patent completed.*

2043. J. Livesey. *A new textile fabric for embroid trimmings, and other ornamental purposes, and machine employed in making the fabric into trimmings.* Dated August 16, 1861.

This new textile fabric consists of a narrow band o braid made with pile loops; the loops are worked different intervals, and the fabric is so manufactured as allow of its being worked into curves and ornamen forms. The invention further consists in an arrangem of machinery, carrying scissors in such manner as to en a workmen with facility to cut or leave uncut such tions of the pile as are desired for the purpose of forming ornamental work required with the new textile f

The invention also consists in arranging machinery in such manner as to bring two or more threads into work to be twisted round each other, so that at different intervals of the twisting, the bands or braids hereinbefore referred to, may be placed between these threads to hold them in the position to form different designs. These threads may also have wire threads twisted with them when required, and needles may be added and used for further fixing the pat erns of the trimming or design required. *Patent completed.*

2044. A. V. Newton. *Improvements in knitting, and in machinery therefore.* (A communication.) Dated August 16, 1861.

This relates to the knitting of stockings, or other articles of irregular form, upon a circular, or straight series of needles, by bringing the whole series of needles at once into connection with their driving, or operating mechanism, and throwing any number at a time out of connection with such mechanism as the form of the article to be knitted may require, leaving all the others in operation, and allowing the knitting to proceed on any number of immediately adjacent needles at once, with a separate yarn to each needle. *Patent abandoned.*

2045. H. C. Hill. *Improvements in the construction of fire-proof buildings.* Dated August 17, 1861.

This consists in making the beams, girders, columns, &c., used in the construction of buildings, hollow, for containing water, or other liquids, and in connecting these beams, girders, columns, &c., so that the water, &c., with which they are filled may circulate therein, or be renewed when required. *Patent completed.*

2046. T. Settle. *A certain improvement in machinery, or apparatus employed in preparing cotton, wool, flax, and other fibrous substances for spinning.* Dated Aug. 17, 1861.

This applies to such descriptions of machinery as are used for preparing, roving and slubbing cotton, flax, &c., wherein the apparatus known as the presser flyer is used, the present improvement relating to such apparatus termed the presser flyer. The improvement consists in forming a groove, or channel in the presser, the yarn being passed once, or twice round the presser arm, and into the groove, which will be found sufficient to guide it in the required direction, instead of through the eyelet as usual. *Patent completed.*

2047. E. Sutton. *Certain improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning.* Dated August 17, 1861.

This relates to that description of machinery used in the preparation of cotton, and other fibrous materials, known as the scutcher or opener, and is designed for the purpose of extracting dirt, and other extraneous matter from the fibres under operation. This consists, 1, in fixing a plate, perforated or otherwise, and of suitable material, behind the beaters used in such machines, and in perforating the covers of such beaters, the plate being secured near to, and behind the beater cover, or covers, and provided with hinges and screws to regulate the admission of air behind the beaters. Beneath, or at the under-side of the beaters, and at certain convenient positions, pipes or tubes are arranged in connection with a revolving fan, so as to exhaust the air, and with it the dirt beneath the beaters, and thereby to separate dirt and extraneous matter from the cotton, preparatory to spinning. 2. In affixing to the carding engine a roller, or cylinder, furnished with a number of blades upon the periphery, that are placed in contact with the "licker in," and driven at a suitable speed in the opposite direction thereto, for the purpose of separating the dirt from the cotton, as it passes into the carding engine. *Patent completed.*

2018. M. H. Randle. *An improvement in sous-juppe, or under-petticoats, for distending articles of dress, in preserving the shape or form thereof.* Dated August 17, 1861.

Here the inventor takes a number of lengths of steel (such as is used by watchmakers), and makes them into circles or hoops, attaching to each end a slide, a buckle, or fastener, and stamps holes or curves in the centre of the steel spring of sufficient length to enable the wearer to make whatever circumference she may wish. *Patent abandoned.*

2049. P. Walters. *Improvements in machinery for cutting, sawing, and slicing, or planing wood and other substances.* Dated August 17, 1861.

Here, on a strong framework of wood or iron, fixed or mounted on standards, a bed plate is arranged, on which a slide, having suitable grooves to correspond with the bed plate, is caused to move with a reciprocating motion by a connecting rod attached to the crank of a driving axle. The wood or other material to be operated upon is attached to the upper surface of the slide, above which a suitable plane, saw, or other cutting or slicing apparatus is secured by standards, bolted to the framework. By these arrangements, at each revolution of the crank a slice of wood or other substance is taken off of the desired thickness, and the cutter may be so regulated as to sheave or slice the wood of such thickness that it will curl or roll up, and form spills, or a thicker slice may be obtained for many purposes. *Patent abandoned.*

2050. Z. Colburn. *Improvements in apparatus for heating water intended for the supply of steam boilers.* Dated August 17, 1861.

This consists of apparatus for heating the water intended for the supply of steam boilers to a temperature not only above that at which water boils in the open air, but up to or above the temperature at which the water is maintained in the boilers when in regular working. The heat for thus heating the feed water for one or more boilers is not to be derived from any waste heat escaping from the furnaces or flues of the boilers themselves, but is to be derived from the steam escaping from a supplementary engine, worked by steam of a pressure considerably higher than that maintained in the boiler or boilers, the feed water for which is to be heated. *Patent abandoned.*

2051. P. Hart. *An improvement in mills for grinding.* Dated August 17, 1861.

In treating mill stones according to this invention, the inventor proposes to dress only the runner stone in any well-known or approved way, and to provide the fixed stone or bed stone with a smooth, or approximately smooth, or unchannelled surface. *Patent abandoned.*

2052. R. Caunce. *Improvements in carding engines.* Dated August 17, 1861.

This consists in passing a stripping bar, suitably clothed with wire, under the tops or flats of carding engines, for the purpose of stripping them. The blank side of the stripping bar is fitted at each end with an adjustable concave or other formed slide, which moves or slides on a plain or grooved arc, concentric with the main carding cylinder shaft, and is fitted on the sides or bends of the carding engine. The upper or stripping side of the stripping bar is fitted at each end with an adjustable incline or curved elevator for raising the tops in suchwise as to enable the stripping bar to pass under to strip them. The stripping bar after passing from under the tops is carried over them by a suitable chain towards the top first stripped, and during its passage is itself stripped by the segments of a roller suitably covered with wire, and this segment during its backward motion is doffed by a comb. In applying the invention to the hand stripped carding engine, it may be desirable to connect the tops or flats with suitable links, so as to prevent them getting out of position. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Nov. 23, 1861.

2950. F. De Wylde, 10 Great College-street, Camden-town. Improvements in paper-making machinery. (A Communication.)

Dated Nov. 26, 1861.

2972. C. Stevens, 31 Charing-cross. An improved indelible anti-corrosive ink. (A communication.)

Dated Dec. 24, 1861.

3221. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved means for reducing the friction and wear of slide valves of steam engines. (A communication.)

Dated Dec. 31, 1861.

3274. E. T. Hughes, 123 Chancery-lane. Improvements in saddles. (A communication.)

Dated Jan. 13, 1862.

87. A. G. Southby, Bulford, Wilts. Improvements in the preparation of pulp for paper making.

Dated Jan. 15, 1862.

112. E. Lord, Todmorden, machine maker. Improvements in check straps, applicable to looms for weaving.

115. J. Ridsdale, Minories, engineer. Improvements in preparing sheet lead for covering floors, stairs, and other like purposes.

Dated Jan. 18, 1862.

137. S. Dreyfous, Paris, C.E. An improved throstle spinning frame. (A communication.)

Dated Jan. 21, 1862.

150. J. Stenhouse, 11 Upper Brunswick-terrace, Barnsbury-road, chemist. Improvements in the protection of metallic surfaces, and in rendering certain substances less pervious to air and moisture.

Dated Jan. 23, 1862.

171. J. Tomlinson, Liverpool, iron bedstead manufacturer. Improvements in washing machines.

173. F. W. Werner, Mannheim, Baden. An improved method of and apparatus for destroying vermin.

Dated Jan. 28, 1862.

213. J. List, Carisbroke, I. of W. An improved means and instrument for obtaining distances and heights and distances between distant objects without computation.

215. S. and T. Smith, Nottingham, cord and twine manufacturers. Improvements in the manufacture of cord and twine from mill-spun yarns.

222. S. C. Lister and J. Warburton, Manningham, near Bradford, York, spinners. Improvements in preparing cotton for spinning.

226. R. Bodmer, Newport, Monmouth, and W. Wilson, foreman, Newport. Improvements in the process of manufacturing artificial stones, parts of which improvements are also applicable to the manufacture of artificial fuel.

Dated Jan. 29, 1862.

229. J. H. Brierley, Park-terrace, Halifax, manufacturer. An improved clasp or fastener for reversible belts, bands, or straps.

233. J. McKean, Walmer Bridge Mills, near Preston, manufacturer, and J. Gabbott, manager. Improvements in sizing or dressing yarns or textile materials.

Dated Jan. 31, 1862.

254. H. White, 13 Mornington-place, Hampstead-road. Improvements in shirt collars.

Dated Feb. 1, 1862.

269. W. Smith, Bury. Improvements in machinery for the manufacture of bricks, tiles, or other articles of a similar nature or character.

273. J. Hill, 212 Piccadilly, travelling equipage maker. Improvements in the construction of portable chairs and other articles for sitting or reclining on, road, Bath, Invalid, wheel, and children's carriages, ambulances, or vehicles for carrying sick or wounded persons.

Dated Feb. 3, 1862.

283. D. Joy, Manchester, engineer. Improvements in machinery for forging metals, also applicable to other purposes.

285. C. Stevens, 31 Charing-cross. An improved axle-tree. (A communication.)

Dated Feb. 6, 1862.

313. R. Russell, Derby, stove grate manufacturer. Improvements in stove grates and kitchen ranges.

317. E. C. Willis, Addison-road, Kensington, bachelor of medicine. Improvements in the treatment of wax and other substances of a similar nature.

319. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the preparation of pulp for paper. (communication.)

321. J.-D. Dunnicliff, Nottingham. Improvements in the manufacture of lace or net bonnet fronts and other similar articles, and in apparatus used in this manufacture.

Dated Feb. 7, 1862.

325. H. A. Silver, Silvertown, manufacturer. Improvements in the manufacture of trays, cases, and other similar articles and bottles, in ebonite, vulcanite, or other hard india-rubber.

327. A. McKenzie, Glasgow, engineer, and F. Panthel, machinist. Improvements in sewing machines.

329. H. Macaulay and A. F. Notley, Rotherham, York. Improvements in fire guards.

331. H. Brinsmead, Ipswich, machinist. Improvements in apparatus for moving, elevating, cleaning, and dressing grain.

Dated Feb. 8, 1862.

333. J. Howie, Hureford Colliery, Kilmarnock, coal master. Improvements in regulating the consumption of fuel in furnaces.

337. J. Carrington, Queen's Gate Mews, Kensington, groom. Improvements in the construction and fitting up of stalls and horse boxes.

Dated Feb. 10, 1862.

339. M. A. F. Mennons, 39 Rue l'Echiquier, Paris. Improved apparatus for the administration of vapour baths. (A communication.)

341. R. and J. Philp, Lower John-street, Golden-square, civil engineers. An improvement in propellers for propelling ships, boats, and other vessels in water.

343. B. C. T. Pim, Junior United Service Club, St. James's, commander in the Royal Navy, and G. Fawcus, North Shields, ship builder. Improvements in uniting iron plates and in uniting and fixing armour plates on ships and other structures.

345. G. Smith, Holland-grove, North Brixton. Improvements in shawls.

Dated Feb. 11, 1862.

353. E. Sotton, Radcliffe, cotton spinner. A certain improvement in machinery or apparatus for preparing cotton and other fibrous substances for spinning.

355. W. Lyall, Amiens, France. Improvements in machinery for preparing flax, hemp, and other fibrous substances.

358. J. Brinsmead, Charlotte-street, Fitzroy-square, pianoforte manufacturer. Improvements in pianofortes.

361. J. J. McComb, Pump-court, Temple, gentleman. An improved fastening for securing cotton and other bales or packages.

363. J. Hetherington, Manchester, machine maker. Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

Dated Feb. 12, 1862.

365. J. Robb, Aberdeen, merchant. Improvements in entilation and in apparatus employed for that purpose.

367. J. Brickhill, 5 Stepney Causeway, Commercial-road East, mechanic. Improvements in the cylinders and pistons of steam engines.

369. A. Hinshaw, Aldermanbury Postern, manufacturer. Improvements in hooped skirts. (A communication.)

370. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in preparing and ornamenting cast iron and other metals, in order to fit them for articles of furniture and decoration and other similar uses. (A communication.)

371. J. S. Joseph, Rhostyllan, near Wrexham. Improvements in coke ovens, and in utilizing the waste heat from the same.

373. A. Samuelson, 28 Cornhill. Improvements in building ships and vessels.

Dated Feb. 13, 1862.

376. J. S. Joseph, Rhostyllan, near Wrexham. An improved retort oven, and the utilization of the spare heat from the same.

383. C. D. Abel, 20 Southampton-buildings, Chancery-lane. Improvements in towing boats or other vessels on rivers, and in apparatus employed for that purpose. (A communication.)

391. J. E. McConnell, Wolverton, engineer. Improvements in parts of boilers and furnaces for locomotive and other engines.

393. J. E. McConnell, Wolverton, engineer. Improvements in railway breaks and in warming railway carriages.

395. W. G. Valentin, Royal College of Chemistry, Government School of Mines, Oxford-street, chemist. An improved mode of and apparatus for coking coal.

Dated Feb. 14, 1862.

396. S. B. Whitfield, Birmingham, manufacturer. Improvements in the manufacture of iron bedsteads, and in the manufacture of ornamental iron tubes or columns for the construction and ornamentation of iron bedsteads.

397. A. J. Dodson, Clapham, C.E. An improved composition for coating, covering, or protecting ships' bottoms, applicable also for coating or covering railway sleepers, telegraphic wires, and other surfaces, and likewise as a cement and as a substitute for metal for certain constructive purposes.

398. W. Clark, 53 Chancery-lane, engineer. Improvements in mounting and fixing the handles or knobs of doors, furniture, and other articles. (A communication.)

399. T. D. McFarlane, Glasgow, machinist. Improvements in sewing machines.

400. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in machinery or apparatus for propelling ships and boats. (A communication.)

401. W. F. Smith and A. Coventry, Gresley Iron Works, Ordsal-lane, Salford, engineers and machinists. Improvements in, and applicable to, lathes for turning and cutting screws.

Dated Feb. 15, 1862.

406. G. H. Law, 17 Rochester-road, Camden New Town, Middlesex, gentleman. Improvements in the construction of steam and other boilers.

408. C. Turner, Airedale Woollen Felt Mills, Leeds, manufacturer, and J. Shaw, manager. Improvements in felted fabrics.

412. R. Bunting, Sheffield, spring knife manufacturer. Improvements in the manufacture of bolsters and scales, and in machinery employed therein.

414. R. Bell, 41 Westland-row, Dublin, Esquire. Improvements in treating fabrics or articles composed of animal and vegetable substances, for the purpose of separating one class from another.

416. J. Green, Newtown, Worcester, farmer. Improvements in the method of and apparatus for signalling, which improvements apply to signals used with steam ploughs or cultivators.

Dated Feb. 17, 1862.

418. F. W. Gerish, East-road, City-road. Improvements in pumps.

420. J. Hodgkinson, cotton spinner, and D. Greenhalgh, manager, Bolton, Lancaster. Improvements in machinery or apparatus for preparing or combing cotton, wool, and other fibrous materials.

Dated Feb. 18, 1862.

430. J. Lees, Rookery, Salterhebble, near Halifax. An improved trap for catching rats, mice, birds, and other animals alive.

434. W. Firth, Burley, Leeds, merchant. Improvements in machinery for digging or turning up soil.

Dated Feb. 19, 1862.

436. J. T. Pendlebury, blacksmith, Elton, near Bury, and G. Pendlebury, maker-up, Tottington-lower-end. Improvements in machinery for doubling, folding, or plaiting cloth.

440. W. B. Adams, Holly Mount, Hampstead, engineer. Improvements in springs and their arrangement for moving and stationary purposes.

444. W. Davis, Spencer-road, Stoke Newington, oil refiner. Improvements in increasing the illuminating effect of coal gas and other gases.

446. J. Gregory, Wellington, Somerset. Improvements in candlesticks.

448. J. Willcox, Ludgate-hill, sewing machine manufacturer. Improvements in the manufacture of frills or ruffles, and in the machinery or apparatus employed therein. (A communication.)

Dated Feb. 20, 1862.

450. J. Friedlaender, White Abbey, Antrim, Ireland, C.E. Improvements in machinery for scutching, breaking, and preparing flax, hemp, jute, and other fibrous substances.

454. R. T. Pritchett, Saint James'-street, gun manufacturer. Improvements in targets or butts.

456. J. Paterson, Middle Temple, barrister at law. Improvements in means or apparatus for facilitating the evaporation of saccharine solutions.(A communication.)

458. Lord A. S. Churchill, 16 Rutland-gate, Hyde-park. Improvements in electric telegraphs.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

500. J. Imray, 65 Westminster-bridge-road, Lambeth, engineer. Improvements in hinges. Dated Feb. 25, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2619. H. Bloxam. Sights for rifles and ordnance.

2620. H. Lamplough. Igniting the wicks of candles and lamp wicks.

2624. E. Oldfield. Spinning and doubling.

2642. G. Archer. Sewing boots and shoes.

2646. C. Brison and A. Chavanne. Ovens, kilns, or furnaces.

2661. T. Morris, R. Weare, and E. H. C. Monckton. Insulating.

2663. W. Dicks. Water meters.

2668. W. Wharton. Springs.

2674. E. Alexandre. Pedal box.

2675. T. Moore. Windlasses.

2677. T. Richardson and R. Irvine. Treating bones and gelatine.

2680. B. J. La Mothe. Railroad cars.

2682. F. Barnett. Electric danger signals.

2693. G. Hutton. Coverings for the head.

2694. W. Smith. Preservation of stone.

2598. W. Ryder and T. Ryder. Machinery for fluting rollers.

2703. O. Bayliss. Guns.

2710. R. Gibbon. Preparing grain.

2711. J. Eaglesfield. Gas burners.

2712. J. S. Jackson. Woven fabrics.

2714. J. Hayward. Raising water.

2716. J. H. Johnson. Skins and hides. (A communication.)

2719. M. A. F. Mennons. Horticultural cases. (A communication.)

2728. A. T. J. Topham and J. Topham. Manufacture of lace.

2735. G. Holcroft. Blast furnaces.

2736. W. L. Thomas. Rifled ordnance and projectiles.

2749. M. Henry. Steam engines, and boilers. (A communication.)

2752. J. S. Brooks. Braces.

2758. A. F. Yarrow and J. B. Hilditch. Cultivating land.

2760. T. Lockie. Wrought iron wheels.

2762. S. W. Worssam. Cutting wood.

2779. E. Bowra. Elastic fabrics.

2789. F. H. Schroder. Evaporating.

2819. R. A. Brooman. Obtaining alkaline phosphates. (A communication.)

2841. W. E. Newton. Skates. (A communication.)

2850. W. Clark. Refining cast iron. (A communication.)

2896 R. A. Brooman. Reaping machines. (A communication.)

2907. B. D. Godfrey. Boot or shoe.

2918. W. L. Thomas. Ordnance.

2940. E. A. Rouviere. Pump.

3041. W. E. Newton. Pumps. (A communication.)

3191. J. Westwood. Hydraulic presses.

3221. A. V. Newton. Reducing the friction and wear of slide valves. (A communication.)

192. W. Baker. Fire-arms.

217. J. Hunt. Chandeliers.

223. G. H. Morgan and E. Morgan. Carriages.

273. J. Hill. Portable chairs.

354. W. Macnab. Steam engines.

380. W. Hewitt. Rein holders.

412. R. Bunting. Bolsters and scales.

456. J. Paterson. Facilitating the evaporation of saccharine solutions. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated Feb. 28, 1862.

2206. R. McConnel.

2207. J. M. Rowan and T. R. Horton.

2208. C. Edkins.

2209. J. E. Ridges and J. Barker.

2211. P. Effertz.

2225. W. Spence.

2231. J. Browm.

2237. W. Ainsworth, E. Head, W. Fielding, and E. Openshaw.

2238. N. D. P. Maillard.

2240. G. Norris.

2255. J. Anthony.

2332. J. Gurman.

2357. W. G. Creamer.

2558. W. Macnab.

2597. C. D. Abel.

2569. E. Chambers.

2715. J. H. Johnson.

2745. M. and M. Myers and W. Hill.

2920. J. H. Johnson.

3197. J. Redfern.

Sealed March 4, 1862.

2213. F. Bennett.

2229. C. F. Kirkman.

2235. T. G. Messenger.

2241. J. Holland and G. Okell.

2246. W. Simons.

2249. A. Fryer.

2253. R. A. Brooman.

2265. C. Greaves.

2269. W. W. Clay.

2275. P. Dubrule.

2286. J. A. Knight.

2291. J. King and J. Sutcliffe.

2294. A. Green and W. H. Glover.

2334. J. Clough.

2398. G. Russell.

2411. S. Rowsell.

2511. S. Bremner.

2536. W. E. Newton.

2543. W. E. Newton.

2569. W. E. Newton.

2988. H. Mearing.

3096. T. Higgins.

3252. J. P. Dormay, J. S. Aikenhead, and T. Johnson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

513. W. McNaught.

514. R. Fielden and J. T. Fielden.

526. J. Howden.

528. G. Horner.

531. C. Hall and C. Hall.

539. Rev. H. Moule.

543. J. Templeman.

544. J. Pile.

545. D. Lichtenstadt.

576. R. A. Brooman.

579. J. M. Dunlop.

664. W. Avery.

810. F. Morton.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

445. H. C. Jennings.

454. G. M. Miller.

478. R. Boby and T. C. Bridgman.

529. J. Bullough.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending March 1, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	P	
	s	d		s	d		s	d		s	d		s	d		s	d
1837	0	3	1845	0	3	1853	0	6	1861	0	3	1869	0	3	1877	0	6
1838	0	3	1846	1	7	1954	0	2	1862	0	7	1870	0	3	1878	0	3
1839	0	5	1847	0	6	1855	0	3	1863	0	3	1871	0	7	1879	1	7
1840	1	0	1948	0	3	1856	0	3	1864	0	3	1872	0	3	1880	0	6
1841	2	6	1849	0	3	1857	0	6	1903	0	9	1873	0	5	1881	3	5
1842	0	3	1850	0	3	1858	0	11	1866	0	3	1874	0	6	1882	0	10
1843	0	9	1851	0	10	1859	0	9	1867	0	3	1875	0	7	1883	0	6
1844	0	3	1852	0	3	1860	0	3	1868	0	5	1876	0	7	1884	0	10

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.		Nos. in Register.	Names and Addresses.	Subjects of Design.
Jan.	6,	1300	W. Parker. Bath.........	Splint.
,,	,,	1301	W. Parker, Bath.........	Splint.
,,	13,	1302	J. J. Pratt, Islington...	Skirt improver.
,,	15,	1303	B. Nicoll, Regent-circus	Shirt collar.
,,	16,	1304	J. L. Arthur, Walworth	Air interceptor.
,,	22,	1305	C. Burn, Westminster	Tramrail.
,,	23,	1306	W. Richardson, Kennington	Ladder.
,,	,,	1307	J. White, Finchley	Life buoy.
,,	24,	1308	J. Tover, John-street	Seat.
,,	27,	1309	J. Kidd, Walworth.....	Carburating gas.
Feb.	3,	1310	P. Palmer, Shrewsbury	Wood spills.
,,	,,	1311	Goostry and Law, Birmingham	Top.
,,	4,	1312	C. Topham, Bush-lane	Rotating brush.
,,	8,	1313	A. S. Macrae, Liverpool	Neck-clamp.
,,	17,	1314	M. Blane, Birmingham	Boot.
,,	,,	1315	J. Taylor, Edgbaston...	Bolt.
,,	18,	1316	J. W. Bailey and C. Lefever, Fenchurch-street	Compass.
,,	21,	1317	Lomley and Watson, Shadwell	Stuffing box gland.
,,	27,	1318	H. Bartlett and J. Ban, Ampthill-square	Needle threader.
,,	,,	1319	Lumley and Watson, Shadwell	Metal Packing.
,,	28,	1320	J. F. Bland, Dorset-sq.	Target.
Mar.	1,	1321	A. Le Moignent and S. Nowakowski, Sloane-street	Tie collar.
,,	,,	1322	W. H. Hook, Walworth	Envelope.
,,	3,	1323	W. Griffiths, Birmingham........................	Wind sight.
,,	4,	1324	Field & Sons, Fore-st.	Bonnet.
,,	5,	1325	A. W. Banks ,Newgate-street	Sponge bag.

PROVISIONAL REGISTRATIONS.

Dates of Registration.		Nos. in Register.	Names and Addresses.	Subjects of Design.
Jan.	3,	4429	R. & G. Gray & Co., Sheffield	Paragon crinoline.
,,	6,	4430	Perkins and Gotto, Oxford-street..............	Paper knife.
,,	10,	4431	W. T. Henley, St. John-street-road	Insulator.
,,	16,	4432	J. W. Fereday, Wednesbury	Kerbing.
,,	17,	4433	Key, Hoskins, and Co., Birmingham......... ..	Connection for the rails of metallic bedsteads
,,	,,	4434	C. Alsop & G. Maguire, Camberwell	Clothes horse.
,,	18,	4435	J. J. Pratt, Islington...	Skirt improver.
,,	22,	4436	D. Stewart, Lincoln's-inn	A butt.
,,	28,	4437	W. J. Miers, Lamb's Conduit-passage	Machine for cutting ovals.
,,	29,	4438	J. P. Bland, 76th Regt.	Register folio.
Feb.	10,	4439	C. Bell and J. Pratt, Kettering	Diamond tile.
,,	15,	4440	Z. Shrimpton, Redditch	Office pin.
,,	18,	4441	Powell & Sons, Bristol	Jar.
,,	19,	4442	A. J. Rix, Cheapside ...	Scarf.
,,	22,	4443	Kennan & Sons, Dublin	Tilt gear.
,,	26,	4444	J. K. Turner, Sheffield	Spectacles.
Mar.	1,	4445	T. Pemberton & Sons, Birmingham............	Window catch.
,,	3,	4446	Roberts & Sons, Sheffield............................	Office knife.
,,	,,	4447	A. Somerville, Birminghem	Pattern card.
,,	4,	4448	J. Wheeler and C. Tighe, Poultry	Collar & cravat
,,	,,	4449	J. Oarland, Birmingham............................	Weighing machines.
,,	,,	4450	C. S. Windover, Huntingdon	Tessatempora.

PRICES CURRENT OF METALS.

London, March 6, 1862.

		£	s.	d		£	s.	d	
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	6	0	0	,,
Welsh Bars, in Wales	,,	5	5	0	,,	5	7	6	,,
Staf. Bars, at the Works ..	,,	5	10	0	,,	7	5	0	,,
,, Hoops	,,	7	10	0	,,	8	0	0	,,
,, Sheets, Singles	,,	8	0	0	,,	9	0	0	,,
,, Nail Rods	,,	5	15	0	,,	8	10	0	,,
,, Boiler Plates	,,	8	0	0	,,	8	10	0	,,
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2	9	0	,,	2	9	3	nett
Do. No. 1, Good Brands ..	,,	2	11	0	,,	2	15	0	,,
Scotch Bars	,,	7	5	0	,,	7	15	0	,,
Swedish Bars, in London ..	,,	10	10	0	,,	11	0	0	,,
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	,,	0	0	0	[illegible]
Tough Cake and Tile......	pr. ton	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Australian	,,	97	0	0	,,	0	0	0	,,
South American	,,	0	0	0	,,	0	0	0	,,
Yellow Metal Sheathing ..	per lb.	0	0	9½	,,	0	0	0	[illegible]
STEEL:									
Swedish Keg..............	pr. ton	15	0	0	,,	0	0	0	[illegible]
,, Faggot	,,	16	0	0	,,	0	0	0	,,
TIN:									
English, Block............	p. cwt.	6	1	0	,,	0	0	0	[illegible]
,, Bar...............	,,	6	2	0	,,	0	0	0	,,
Foreign, Banca	,,	6	1	0	,,	0	0	0	nett
,, Straits	,,	5	17	0	,,	0	0	0	,,
TINPLATES:									
Charcoal, I.C.	pr.box	1	7	0	,,	1	9	0	[illegible]
Coke, I.C................	,,	1	1	6	,,	1	4	0	,,
LEAD:									
Pig, English	pr. ton	20	5	0	,,	21	10	0	[illegible]
,, Spanish	,,	20	0	0	,,	21	0	0	,,
Common Sheet	,,	21	10	0		23	0	0	,,
Tea ,, (Wimshurst's Patent) A special disct...	,,	35	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	0	0	,,	0	0	0	nett
For arrival	,,	18	5	0	,,	18	7	6	
ZINC:									
English Sheet	,,	24	0	0	,,	0	0	0	[illegible]
QUICKSILVER............	pr. btl.	7	0	0	,,	0	0	0	[illegible]

JAMES LAURIE Metal Broker.

10 Old Jewry Chambers, E.C.

Digitized by Google

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 14, 1862.

THE BUILDING FOR THE INTERNATIONAL EXHIBITION.

We find that exertions of an almost superhuman kind are being made by the contractors, and others concerned, to effect the completion of the Exhibition building by the required time. We do not for a moment doubt that those exertions will, in the main, if not in the detail, be crowned by success. Englishmen are proverbial for keeping their business arrangements. They seem to take a delight in embarking in difficult enterprises, as if for the simple purpose of accomplishing them, and thus astonishing the world. The rapidity with which the Exhibition building has progressed, in truth, reflects the highest credit on Messrs. Kelk and Lucas. They have thus far achieved the work set out for them by Captain Fowke, with an amount of talent, energy, and industry which entitles them to the highest praise, and which we trust will ensure for them fame and fortune in the future.

Gladly would we congratulate, with equal fervour and sincerity, the designer of the vast edifice—Captain Fowke. This, however, is impossible. The whole structure is a gigantic mistake. Exteriorly, it is of the most incongruous character, and in its massive and extended outline it is difficult to point out a single redeeming feature. The very form of the building militates against its architectural beauty. The proportions of the graceful Exhibition building of 1851 were indeed much more favourable to the production of harmonious effect than those of the edifice now rising to shelter the products of the world's industry. And here, perhaps, a comparison of the dimensions of the two buildings may not be misplaced. The site of the present Exhibition forms a portion of the ground belonging to the Commissioners of that of 1851, and in the whole it extends from the Cromwell-road to the gardens of the Horticultural Society, north and south. It is bounded on the east and west by Albert, and Exhibition Roads. The total area covered by the building will be 21¼ acres, or nearly double that of the Crystal Palace of 1851. The total length of the latter was 1851 feet, and its width 400 feet. The building of 1862 is 1200 feet in length, by 700 in width, but these figures do not include the two "annexes," to be used for the exhibition of agricultural implements, &c., and which are each 1,000 feet in length, and 220 feet in width.

What is called the main front of the building occupies one side of the Cromwell-road for a distance of 1,200 feet, and assuredly this *façade*, if *façade* it must be termed, is not of a nature to please either the educated or the uneducated eye. One unbroken and mathematically straight line of brick wall, unrelieved by recesses, except the one large and four small entrance porches, and thirty odd arched window spaces, comprises this grand *façade*, which cannot but invite the hostile criticism of all our visiting friends. The brick and compost front wall is surmounted by the angular-glazed skylights of the Picture Gallery, and these serve by no means to reduce the meagre character of the *façade*. It must not be imagined that because the principal front of the new exhibition building is in the Cromwell-road, therefore the main entrances are in the same road or street. Had an ordinary architect been entrusted with the designing of the edifice such a conventionality might have been observed, but the extraordinary *artiste* really engaged has thought fit to place the principal entrance to the Great Palace of the Arts and Sciences in the sides of the building.

These entrances are crowned by the monster domes, which, viewed from the heights above Battersea resemble two gigantic wens rising from the Brompton plains, and having no connection with each other. The entrance porches are formed of brick, and are said to be "sus-"ceptible of any amount of decoration." Whether they will get it or not the official account saith not, but at present they are unmitigatedly plain, not to say positively ugly.

What object Captain Fowke had in view when he determined that the level of the ground upon which the building should be placed should be "five feet below the level of the surrounding thoroughfares" we know not, but assuredly the fact that it is so seems to every other person to be a mistake. It was the custom at one period, and that within the recollection of some of our grandfathers, to construct houses in the same fashion. "Stepping in" to visit a friend might very properly have been termed in those cases stepping "down" to visit him, for the floor of the front parlour was, in many instances, two or three feet "below the level of the surrounding" roads. The advantages of this mode of building may have been apparent to our venerated progenitors, but latterly the rule has certainly been reversed, and, as we think, with satisfactory results. Why Captain Fowke has reverted to the *effète* style of architecture in question, he may know, but to all others the problem is a puzzle.

We are obtuse enough, even after perusing the "official account" of the building, not to see the force of a remark which occurs therein in reference to the variation in level of which we complain. We are told that, "by a happy concep-"tion, Captain Fowke has used this condition "to obtain a most picturesque feature at each "end. Instead of descending into the building "on entering, the visitor *ascends* two steps to "a great platform or dais under each dome, and "then may descend into the nave and transepts "by three noble flights of steps each eighty "feet wide, which lend themselves to most "decorative arrangements, or he may ascend "into the galleries. The entrance is therefore "made on a mezzanine, as it were, of the build-"ing." Had he confined himself to the ordinary rules of architecture, instead of indulging in his "happy conceptions," there is little doubt that he would have avoided much well-earned animadversion, and the public would have been the gainers.

Is it not likely that the sanitary condition of the Exhibition building will be disastrously interfered with by this violation of sense and tastes. To begin with, the general level of the ground in the neighbourhood of the building is forty feet below that upon which stood the Crystal Palace of 1851. How unwise then, to add to the natural difficulties in the way of effective drainage, by making the ground floor of the new edifice five feet below the level of the surrounding thoroughfares!

Advancing beyond the entrance, and *descending* into the nave, we find the *coup d'œil* unsatisfactory in the extreme. Masses of straight lines without anything to relieve their wearying monotony, and floor, galleries, and roof apparently meeting and mixing in confusion at the extreme end. Had the "architect" caused continuous arched supports to have been applied to the galleries and roof, with perforated spandrils, what a pleasing "break" would not have been formed in the sight line, and what an excellent effect would not have been produced by the interlacing arches? In such case, the nave, which now has much more the character of a large workshop or railway shed than the great hall of an industrial palace, would have been converted into, what it should be, a "thing of beauty and a joy for ever."

Did space permit, we should extend our criticisms of the International Exhibition building; for there are, unhappily, several other points about it which call for severe reprehension. Truly it is unfortunate, that with all the indomitable, unceasing, and almost illimitable perseverence of the people of England, there should occur such repeated failures to produce the effects which ought to result from the exercise of that estimable quality.

Somehow, official inaptitude, routine, red-tape, vested interests, or other disastrous influences are perpetually at work, like the evil spirits in a pantomime, to mar the fairest works, and rob the worker of his legitimate reward.

The amount of labour expended on the Exhibition building ought to have ended in the production of a structure of unparalleled grandour. By mismanagement, it has resulted in the creation of a monstrosity, of which all concerned are, or ought to be, ashamed!

LORD PALMERSTON ON THE ARMSTRONG GUN.

Our readers will remember the prominent notice taken by the then Secretary of State for War, Mr. Baring, during last session, of the criticisms in relation to the Armstrong gun published in the columns of the MECHANICS' MAGAZINE. Contradiction, the most formal, specific, and with all the weight of official authority, and in the presence of the members of the House of Commons, was delivered to the world by the Secretary of State for War.

Confident of the accuracy of our information we did not hesitate to doubt, notwithstanding their hardihood, the genuineness of the ministerial explanations, and in our succeeding numbers afforded to our readers from time to time, minute and detailed particulars fully bearing out and thoroughly substantiating every statement made by us in reference to this matter.

It is now our duty to place before our readers the statement of the Prime Minister, published in the *Times* of the 7th March, without other comment than that it fully and completely substantiates all we have stated in relation to the casualties which occurred to our troops in China, and completely puts to the blush the extraordinary, unjustifiable, and most reckless statement which the permanent staff of the War Department thought proper to place before the nation, through the medium of Mr. Baring, the then Secretary of State for War.

Lord PALMERSTON said,—The objections that have been mentioned were noticed in the early period of the use of the gun. The objection was that the lead placed on the iron shot, in order to make it fit the interior groove, stripped off soon after the projectile quitted the muzzle of the piece. That difficulty has now been corrected. The lead is fastened in a manner that prevents it from stripping off until the shot either strikes the ground, *en ricochet*, or the object against which it is directed. *It is satisfactory to know that the difficulty of the lead stripping off the shot, which was attended with great danger to the troops when fired over their heads, has ceased to exist.* With regard to the vent-piece, there was an objection that it was sometimes liable to be blown out in firing. But the cause of this was almost invariably found to be the not placing it properly in the gun,—that is, not allowing it to drop freely into its place. By this means the screw is forced up against the breech, the vent-piece is forced from its position, and a hollow is formed behind it. The consequence is that in firing the gas gets into this space, which if the vent-piece is dropped freely into its position, and the screw acts freely, it cannot do. As to the marine gun, there is another cause that often prevents the vent-piece from being properly screwed up. When the gun is elevated by coigns, these coigns often stop the handle of the breech-screw from working, and prevent it from going completely up; an arrangement is being made to remedy this inconvenience, and when the vent-piece is properly screwed up it is impossible an accident can happen.

The explanations which our veteran and gallant Premier has given to the House require, however, a few observations. The staff of the War Department have committed to his lordship a very mismanaged brief—a strange jumble mixed up with coigns, wholly at variance with the actual drill practice of the Armstrong gun, as the printed directions show, and utterly unintelligible to any one who has ever seen an Armstrong gun fired.

With reference to the danger caused to troops by the stripping of lead, which his lordship assured the House has ceased to exist, we have to inform our readers that a few months' storage causes the shells to revert to their old condition—they are then just as dangerous as ever. Sir William practically acknowledges this by seeking to introduce *shells without any lead on them.*

It is a pity his lordship ever ventured on this explanation with such imperfect or incautious information, and we beg most emphatically to assure him that the statements with which he favoured the House are incorrect.

The veteran Premier is an acute logician, and practised observer. Let him, therefore, weigh well the irresistible logic of facts. Sir William Armstrong achieved his position on the supposition that the gun, and shells, and fuse, known by his name, were perfect, and fit to be a bulwark and tower of strength to the nation. How stand the facts?

At the present moment Sir William Armstrong virtually acknowledges that the Armstrong gun by definition, and on account of which he is Sir William Armstrong, is no longer to be relied upon, as he has, at the present time, before the Select Committee, and under trial, guns of various sizes, 40, 70, and 100-pounders on a totally different principle, and not to be recognised as the gun on which we were taught to rely, and which ministers have even now the temerity in their place in the House of Commons to proclaim a success, at the same time having a full knowledge that the inventor himself proclaims it a mistake and seeks to supplant it by another and totally distinct gun, which gun is a bad imitation of Krupp's Prussian gun, with a portion of the invention of Messrs. Church and Goddard added.

Looking at the millions of money already spent to no result, what confidence can we place on Sir William Armstrong's present scheme? And, furthermore, looking at the facts we have placed before our readers, *what dependence, let us ask, can possibly be placed on any statement in reference to this subject made by the Secretary of State for War, deliberately, and by authority, to the House?*

COUNTERFEIT COINING.

The records of the Central Criminal Court of the past week are of a nature to make the friends of social progress shudder. Every offence, almost, that can disgrace humanity, or cast a slur upon civilized society, found then, in that hall of justice, its votaries and its victims. It is not our mission, however, or our purpose now, to moralise upon the depravity of the age, or to suggest means for stemming the current of crime which seems to have set in. We cannot forbear from noticing, nevertheless, the remarkable increase which appears to have taken place in the commission of one particular branch of crime, and it is that of counterfeit coining.

Last year, considerable pains were taken by the law officers of the crown with a view to condense and consolidate into one act the statutes which had from time to time been framed in reference to the manufacture and uttering of base coin. The efforts of these officials finally resulted in the creation of the "Coinage Offences Bill," which, supposed to meet all the exigencies of the case, passed speedily through both Houses of Parliament, and received the Royal assent. The clauses in the act of 1861 were very numerous, and one section of it was expressly directed to the protection of the new bronze coinage from spurious imitation. As a general rule, the scale of punishments for offences against the coinage of the realm was mitigated by the new Act of Parliament; but considerable ingenuity was displayed by its framers in imagining crimes in reference thereto which never have had, and probably never will have, existence. In spite, however, of all the labour bestowed in the production of the "Coinage Offences Bill," it would seem to be inoperative for the prevention of counterfeit coining. In fact, the evidence of the Central Criminal Court goes to support the idea that it has produced effects directly opposite to those it was calculated to produce.

No less than thirty-three charges of coining or "uttering" base money came before the court in question during the present session; that is to say, thirty-three persons were captured and committed for trial in the metropolis within the space of one month, for this species of crime! Many of the offenders, we grieve to say it, were women. The question arises naturally, how is this rapid increase in the progress of "smashing" to be accounted for? Are there greater facilities now for the prosecution of the illicit trade than heretofore? Is the electrotype more than ever the coiner's friend? Are the public generally becoming less careful in the inspection of current coin than they formerly were? Are the police more vigilant in the pursuit of offenders than has been their wont? Are the Mint authorities more alive to the necessity of following up and prosecuting coiners and utterers than they used to be? Is the coin issued from the royal mint itself of a quality inferior to what it might be, and therefore too easy of imitation? Or is it, as the *Times* of Monday last darkly suggests, a fact that cases of false coining are incited, if not actually "got up" by the metropolitan police or "informers"? These are all questions which are pertinent, and it is important that they should be carefully considered.

For our own parts, we can hardly think with the *Times* that "there are people—of course, "without official sanction—who set up wretched "men and women with apparatus for the sake "of denouncing them, and getting a reward." We cannot think that this theory is a true one, or that "it goes far to account for the multipli-"cation of crimes against the currency." Surely the days have gone by when conduct so dastardly as that alluded to by the leading journal could be practised, with or without official sanction, in this country! No, it is more probable that the apparent increase in the number of offences against the coinage laws is due to some or all of the causes which our own questions above given suggest. The complaints of tradesmen and shopkeepers against the supineness of the law officials of the Mint have for years past been not only loud but deep, and it is more than likely that those complaints have at last reached "the proper quarter," and produced their fruits in the shape of the large crop of counterfeit coiners, whose appearance at the Old Bailey has called forth these remarks.

With respect to the best means of detecting counterfeit coins when tendered, we know of none equal to weighing them in fine balances against genuine ones. Whether in reference to spurious imitations of gold or of silver pieces this holds good, but of course more decisively so in reference to the sovereign and half-sovereign. The "Coinage Offences Bill" makes it illegal to bend good coins in what are called "Coin Testers," or by any other means, and visits the operator, on information and conviction, with a penalty "not exceeding forty shillings." This is a fact not generally known—but a fact nevertheless—hence the necessity for weighing or closely inspecting coins tendered, rather than applying the leverage of the thumb, which is sufficient, frequently, to bend and deface the best coins which left ever the presses of the Royal Mint.

It would seem that the counterfeiters "aim "at higher game" than the new bronze coinage, in respect to the imitation of which we have heard of no conviction or charges, although the difference between the nominal and intrinsic value of the pieces might be supposed to have offered temptation. *Apropos* to the bronze coinage, we may say that the oxydation which has overtaken it in the course of circulation has—as we foretold it would—improved its appearance, and made it far more acceptable to the public than when first issued. The lightness of the pieces, too, is a strong recommendation to them. The pockets of Her Majesty's lieges being no longer "bowed down with "weight of *copper*" as they erstwhile were. We believe, too, that the profit accruing from the coinage of the new money is large, and that the Mint will this year pay its own expenses—including those of prosecutions for false coining and uttering—and in addition leave a surplus amount for the benefit of Mr. Chancellor of the Exchequer.

MARK ISAMBARD BRUNEL.[*]

[SECOND NOTICE.]

In the concluding part of our notice of Mr. Beamish's life of Brunel, three weeks since, we intimated that a serious difference of opinion and statement existed between Mr. Beamish and a writer in the Mechanics' Magazine, on the relative merits of Brunel and Sir Samuel Bentham, in reference to the introduction of block machinery at Portsmouth. After carefully looking into the matter, and with no feeling towards Brunel than that the truth should prevail, we have no hesitation in saying that Mr. Beamish, in his desire to vindicate Brunel, has done but scant justice to Bentham. Mr. Beamish has given what he considers an answer to the Mechanics' Magazine. He has, however, to our thinking, shot wide of the mark, and evaded much of which appeared in this Journal ten years since.

The writer alluded to proved that Sir Samuel Bentham was formerly instrumental in the introduction of machinery for *general* purposes at Portsmouth Dockyard. Mr. Beamish tries to prove that Brunel was mainly instrumental in applying machinery for a *particular* purpose. Let Brunel by all means receive due credit for what he did. He is entitled to the everlasting remembrance of the British people, for his inventions to make ship's blocks with more economy and celerity than they were made before. Do not, however, render him more honour than legitimately belongs to him. And on the other hand do not diminish the reputation which Bentham so honourably earned.

---

[*] Memoir of Sir Mark Isambard Brunel, by Richard Beamish, F.R.S. London, Longman and Co., 1862.

The *Athenæum*, whose reviewer has evidently only seen what Mr. Beamish has to say, considers "the endeavour, whatever may have been the motive, to deprive Brunel of his due honour, has altogether and signally failed." We unhesitatingly apply the same language to Mr. Beamish's attempt to deprive Sir Samuel Bentham of *his* "due honour."

According to Mr. Beamish, the Government consented to adopt Mr. Brunel's plans for block machinery in 1802. As early, however, as 1791, Sir Samuel Bentham patented inventions, and made machinery for working wood, including planing, rebating, tongueing, grooving, mortising, sawing, both coarse and fine work, in carved, winding, and transverse directions, shaping wood in complicated forms, &c. In 1797, the Admiralty authorised the introduction of a steam-engine at Portsmouth, with the professed intention of introducing Bentham's machinery. Bentham, like others, had to contend with red-tapeism in every direction, and years were consumed in advancing his plans. When Brunel's proposal for using block machinery was submitted officially to Bentham for his opinion, on the 15th of April, 1802, he recommended the adoption of the proposal "as a *part* of the system of machinery to be worked by the steam-engine already provided, so as to combine with the machinery *already provided*, or what it may seem advisable to erect in that dockyard."

On the 1st of June, 1803, Bentham, in a letter to the Admiralty, referring to the machinery which was set up at Portsmouth, said:—"Independent of various other uses to which they are applicable, they are, as it were, necessary for the cutting the wood into the proper scantlings and lengths for shells of blocks, and therefore had it not been that Mr. Brunel was apprised of my intention of proposing the introduction of those engines for *general* purposes, he would have regarded some such engines as part of the machinery requisite for his *particular* branch of business." On the 11th of June, 1803, he said: "As Mr. Brunel's apparatus for making blocks, however important, will form a part only of the machinery which is or will be executed at Portsmouth for working wood, &c." It will be seen from these extracts that machinery and engine power had been applied at Portsmouth, not only for making blocks, but for other purposes. Brunel appeared at the right moment, made his proposal to the Admiralty, and his plans being improvements on Bentham's, were adopted.

Brunel devoted his genius and his energies for some years to the rapid and economic production of ships' blocks. At the present time when almost everything is made by machinery, it is almost impossible to estimate the difficulties with which an inventor had to contend sixty years since. The great problem of making steam power do the work of the artizan was then unsolved. Besides, Brunel was a foreigner and a Frenchman, and Frenchmen at that time were regarded with considerable suspicion in England. His labours, however, proved successful, and in his success he added to the wealth and the strength of England. He, of course, expected to be adequately rewarded. In 1803 it was agreed that he should receive from the Government a sum equal in amount to the savings which the public would derive from the use of his invention during one year, a sufficiently small sum we must admit. In 1810 after "seven years' labour, anxiety, expectation, vexation, and disappointment," he received, in accordance with the above-mentioned arrangement, £17,663. When the extravagance, recklessness, and waste of the departments in our day are considered, we feel rather surprised at the niggardliness of the Government fifty years ago. Now such a man as Sir William Armstrong can, with adroit management, introduce and apply a questionable invention which has already cost the country millions sterling. A half a century since, Brunel, the value of whose invention nobody questioned, and which actually *saved* the country upwards of £17,000 annually, could only obtain, through suffering and struggle, an inadequate recompense for his services.

Brunel was essentially an inventor. Besides the inventions we have spoken of, he took out patents for "saws," and "machinery for sawing timber," for "cutting veneers," for "circular saws," for "the manufacture of shoes and boots," for "obtaining motive power," for "saw-mills," for "rendering leather durable," for "forming tunnels," for the "manufacture of tin foil," for "copying presses," for "stereotype printing plates," for "marine steam engines," and "for gas engines." But what occupied his time and attention most were sawing machinery, boot and shoemaking machinery, and last, though not least, the Thames Tunnel.

In 1811 he submitted a comparative estimate to the navy board, showing the importance for substituting machinery in our dockyards for the handwork then in use. The Government, after some consideration, was induced to secure his services in carrying out some proposed improvements at Chatham. Alterations had been suggested to be made at the dockyard there by several eminent engineers; but they all contemplated an increase of space. When the principal plans submitted were explained to Brunel by one of the officers, he observed, "Oh! then, gentleman, you would require the seven league boots of the Marquis of Carabas to go from one end of the yard to the other." After a careful examination of the ground, he suddenly exclaimed, "That hill must be bought." "Oh yes," replied the officer, "Government had been so recommended, but the cost of the removal of so great a mass of earth has deterred them." "Remove that noble hill," replied Brunel. "No, no, but buy it as quickly as possible." The hill was about 2,000 feet in length, and 200 in breadth, and it rose 38 feet above the Medway at high water. Brunel proposed to sink through the hill an elliptical shaft, the diameters to be 72 and 90 feet to the level of the bed of the river, and from the bottom of this shaft to run a subterraneous canal through the mast pond to the river. It was intended that the bottom of the shaft should become a reservoir into which the timber could be floated from the river freed from the sand and gravel which it so plentifully collected in the dragging process through the yard, and which so largely impeded the operations of the saw. The proposal, with other considerable improvements, were adopted, and Brunel's time was occupied for two or three years in superintending their establishment. A great and beneficial change was thereby effected at Chatham, the results of which may be witnessed up to the present time.

English journalists and others are at the present time in the habit of decrying Americans and American institutions for the scandalous manner in which jobbery has recently been carried on by some of the officials of the United States. They appear to forget that officials in this country have, from time to time, been guilty of equally blameworthy practices. Who can forget the green coffee and rotten bacon supplied to our perishing soldiers in the Crimea! But during the earlier part of this century acts still more reprehensible were practised. "Shoes," says Mr. Beamish, "were supplied to the army "which were found inadequate to one day's march. Clay was introduced between the soles to give weight, and therefore the appearance of great strength to the leather." Brunel's attention was called to this disgraceful state of things, and he endeavoured to improve it by inventing machinery for the rapid manufacture of substantial shoes. "The machinery," says Mr. Beamish, "possessed all that symmetry for which Brunel's works are remarkable. The simplicity of the construction also enabled it to be worked by invalid soldiers, many of whom were crippled; yet the superiority of the shoes as regarded durability, finish, and cheapness, was unexampled." We cannot see how this could have been, as Brunel, on account of his shoemaking machinery, was brought to the brink of ruin. It is an insufficient reason to advance that the cessation of the war destroyed Brunel's hopes. Shoes were worn by almost everybody then as now, and if the machinery invented by Brunel was so perfect, and made shoes so cheaply and expeditiously, as Mr. Beamish says, it must have led to gain and not to loss. Besides, a half a century has passed away, and his machinery has not been adopted.

The construction of the Thames Tunnel was the great achievement of Brunel's life. He devoted to it his best energies and his maturest judgment; and it remains to this day, and it is likely to remain for many years, as the most significant monument to his memory. Twenty or thirty years since the Thames Tunnel was regarded as a kind of eighth wonder of the world. Mr. Beamish relates the history of its construction with considerable minuteness and vivacity. Being a co-operator in the great work, he speaks from personal experience. He tells how difficulties were encountered and overcome, and how Brunel, when everyone else almost despaired, was hopeful and confident. There can be no doubt, however, that his engineering calculations were sadly out of joint. Hence the irruptions, the vast amount of money that was sunk, the years that were consumed, and the lives that were lost in performing the work. Brunel succeeded by the aid of liberal parliamentary grants.

With the completion of the Thames Tunnel Brunel's more active life terminated. He had now won fame and honours. He had left traces of his genius in many useful works in England, and in many parts of the globe. He was one of the Vice-Presidents of the Royal Society, a corresponding member of the Institute of France, and had the honour of knighthood conferred upon him. He lived many years in comparative retirement, and was cheered during his declining life to see his son rising in reputation and power. He died on the 12th of December, 1849, in the eighty-first year of his age.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER. III.

THE recent trial at Shoeburyness of the target of the Iron Plate Committee, and the comparison that has been instituted between the mode of its construction and that of the Warrior target, and between the results of the experiments upon both, have attracted so much attention, and are so identified with the subject matter of these letters that they demand especial notice.

The Warrior, which represents a system of iron armour with large plates, with tongued and grooved edges to the plates, with through bolts and with wood-backing, is the joint creation of the Admiralty and the Thames Ship Building Company, but whether its authors have as much confidence in all the points of that fine vessel as they formerly had is perhaps doubtful. One of these points the tongueing and grooving is repudiated; another the through bolt fastening is only tolerated until some better method can be found; but large plates and wood-backing are still upheld by the partizans of the Warrior as decided advantages. The plan of iron casing the Warrior was settled and carried into effect before the special committee on iron came into existence. They are therefore in no way accountable for its deficiencies, and it is a mistake to represent the Warrior section, and the committee's target at Shoeburyness as rival systems. They are both experiments, with this difference, that one is a specimen of a gigantic experiment in the shape of four ships of war, built at the cost of a million, without any previous trials, and the other is one of a series of preliminary trials at an expense of less than two thousand pounds to test important principles. Great credit is due to the committee for the good sense and judgment they displayed in taking steps to bring the principles of backing and fastening to a decisive issue. It would have been well if Government had taken the same course before armour-plating the Warrior. By doing so they would have avoided some of the grave faults committed, as well as an enormous waste of money.

After a long controversy on the properties of wood and iron for ship-building purposes, and the comparative advantages of those materials separately or combined, the opinion of the most eminent ship-builders has for some time been unanimous that ships of war ought to be constructed entirely of iron. The Government authorities came to the same conclusion; and yet, although wood was repudiated as a material in the structure of the armour-plated ships ordered two years ago, the iron hulls of four large vessels were covered with teak planking. This was admitted to be wrong in principle, but a notion prevailed that wood was necessary, not as a part of the ship, but as a protection to the armour-plates against the effect of vibration from the concussion of projectiles, which it was apprehended might damage the fastenings. It became the duty of the iron plate committee to ascertain whether that apprehension was well founded. To carry their object into effect, no better mode could be adopted than to have two targets constructed of the same size and on the same plan, one with, and the other without wood backing, which being determined was acted upon, and these trials are the results.

Your last publication contains a report of the trial of the committee's target on the 4th inst, with some allusion to the trial of the Warrior target on the 21st October. In a daily contemporary, whose naval and military intelligence usually assumes an official form, the results of the experiments on the section of the Warrior are mentioned in terms so contrary to the facts, and such erroneous conclusions are drawn on the subject of wood backing to armour-plates, that it becomes important to represent the result of the two experiments, and the real characteristics of wood backing under a correct point of view.

It is singular that no report of the trial of the Warrior target in October last, appeared in the Times until the 30th November, on which day under the heading "Our Iron-clad Frigates," an exaggerated account of the experiment described it as a complete success. The long silence of the official organ is significant. At the time of the trial it was by no means regarded as successful. It is difficult to conceive what good purpose can be answered by misleading the public in a matter respecting which the exact truth ought to be known. It is absurd to affect secrecy in these target experiments. They cannot be carried on in private; whatever the results may be they are as well known to foreign Governments as to our own. Where it otherwise, it would be proper to abstain from giving publicity to any information relating to our national defences, but as the case stands it is a duty and a public benefit to let the real facts be known.

The following are extracts from the report in the *Times*, of the 30th November:—"No one was prepared for the astounding success of the experiments, during which the target was subjected to every conceivable ordeal of artillery practice; the guns were fired in volleys of threes, and fours, and sixes, simultaneously; the most tremendous missiles—100 pounders, 120 pounders, and even 200 pounder bolts—were directed in vain; strange to say, even under this tremendous trial, the strong teak backing was undisturbed, and the target as a target was as good as ever. The practical result of this grand experiment has been to show that practically, ten inches of teak will do as well as twenty."

The reader of this report, if he had no other information on the subject, would be led to suppose the target had been subjected to a terrific assault of the most formidable missiles, and had proved to be invulnerable. The sober truth places this famous Warrior target trial, in a different light. Let those who wish to be convinced, view the target as it still stands, at Shoeburyness, and judge for themselves, with the help of the following correct account of the firing on the 21st October.

The artillery practice on the target was divided into six rounds. The first, consisted of five shells filled with sand; the second, of five live shells; the third, of six solid shot; three being 100 lb. and one 120 lb. Armstrong, and two 68 pounders, the fourth of three 200 lb. shot singly, the fifth of a salvo of 200 lb. shot, and the sixth of a salvo of six solid shot. In the four first rounds, the guns were fired singly. The ten discharges of shell produced no effect on the armour plates, beyond a slight indentation; nor were they calculated to do any damage to a 4½ inch plate, as it is well known that shell will not fracture an inch plate. The three 200 lb. shot singly, and the three in a salvo fired from a 10 pounder Armstrong gun, with only 10 lbs. of gunpowder, were innocuous; they made less impression than the shells. The projectile force which propelled a 200 lb. bolt from a 100 pounder gun at a low velocity, was quite inadequate to damage the plate in the slightest degree. The third and sixth rounds, each of six shot, of which two missed the target, were the only effective discharges, so that practically, this "tremendous trial" and "every conceivable ordeal of artillery, with the most tremendous missiles," is reduced to the battering of ten shot—namely, six armstrong bolts and four 68 pounders. The "volleys of threes, and fours, and sixes, simultaneously," are imaginary. The salvo of three 200 pounders, was harmless; the only effective "volley" was the last salvo, of which five shots struck the right hand middle plate. But the effect of this one volley was terrific. Three of the shot crushed through the 4½ inch iron, and burying themselves partially in the backing, drove before them large fragments of the plate into the wood, of which splinters are visible through the fracture. The plate was bulged, and forced bodily inwards at the centre, and started at the butts one to two inches from the backing. The additional injury to the same and other plates from these ten shots, was one bolt struck on the head, and driven through the plate, which is cracked—four bolts broken off—five bolt heads protruding from the plate—four bolts stretched one to two inches away from the backing, and probably broken inside the teak—the screw ends and nuts of two bolts broken off inside—two other plates made concave at the middle, and buckled at the ends—seven fractures of the iron at different points—the edge of one plate ripped up a length of two feet, and several cracks at bolt holes. This is the catalogue of effects termed an "astounding success." If another salvo of five or six guns had been discharged against the plate, which it so extensively injured, there is no doubt it would have been broken away from its fastenings. The "nearly two days firing" of the *Times* occupied four hours on the 21st of October, and the time of one discharge, the following morning, when a projectile, cased in steel, was tried, and broke through the plate it struck.

The only ground for claiming the result of this "grand experiment" as a success, is that the hull of the section is not damaged, but as a test of armour-plating it is a decided failure. Wood as a backing is worthless, it is so inferior to iron in density and hardness, that it offers no resistance to projectiles, and yielding to the blows received by the plates it causes their distortion and facilitates their destruction. Of what use are armour-plates if they are knocked off the vessel they are intended to protect? And whatever may be said to bolster up the Warrior plan, there is no doubt that two or three broadsides of 68-pounders at short range would detach more than one plate from her side in a few minutes. Where then would be the invulnerability of this noble frigate? Her teak planking, with the plates shot away, would be exposed to incendiary shells, and large portions of her hull, reckoning about 60 square feet surface for each plate, would offer no resistance to solid shot or shells.

It is not to be supposed that the public will admit the report of the *Times*, which however is the only account bearing anything of an official character, which has been published, as conclusive evidence in so serious a matter, nor can the question be allowed to remain as it is. There is the Warrior target at Shoeburyness, let it be submitted to the severest test by firing salvos against it *a outrance*, as if the frigate it represented were fighting an enemy. But let the shot be 68-pounders, which fired from smooth bore guns, are from their greater initial velocity far more formidable than 100-pounder Armstrong bolts.

The elongated form of the Armstrong bolt greatly diminishes its destructive power. The conical head of which the point first strikes a plate is broken off at the moment of impact, so that a portion of the projectile force is lost in the destruction of the bolt itself. In corroboration of this fact, the heavy portions of bolts, almost entire, are found at the foot of the target, with the cones broken off.

If the choice were between wood backing and no backing at all, the verdict would be in favour of the Warrior; but that is not so. The error committed in comparing the results is the assumption that because wood protected the frame of the Warrior section, and the absence of wood was a cause of damage to the Committee's target, wood must be used as a backing, although it causes the destruction of any plates. If any system of armour-plating is of such a nature that concussion will detach the plates from the ship, it matters little whether the want of backing or an *in*efficient backing be the cause. Now that is the state of the case with reference to these comparative experiments, and it would be unwise to place any reliance on an erroneous and highly-coloured report, which announces as an "astounding success" an experiment which virtually and practically is a complete failure.

Government, through the Iron Plate Committee, are now doing what they ought to have done a long time ago. The functions of the committee are practical and experimental, not theoretic. They have to ascertain and examine facts for which they have but one rule, actual experiment. In the committee point of view, the result of the trial of their target is satisfactory, because it is a solution of an important point, the effect of vibration, on which much doubt existed. But it must be remembered, that the Warrior target trial had previously solved another point no less important, the inefficiency of wood as a backing. Indeed, it was the means of correcting this inefficiency which became the object of anxious enquiry with the Special Committee immediately after the trial came off, and led to the determination of having targets constructed on plans proposed by several inventors without wood backing.

In alluding to this trial of the Warrior section, great stress is laid by those who wish it to be regarded as a triumph, on the assertion that no ship in action would be exposed to the same amount of punishment as the target suffered. But it is impossible to conceive that a salvo of six guns and four or five single shot can bear any comparison in respect of destructive power with broadsides of thirty or forty heavy guns. The battles which are in the recollection of naval men were fought with guns of inferior calibre and force to those now in use. The quick and total destruction of the Turkish fleet at Sinope, is an example of the terrific character of modern projectiles, which since that event have been greatly increased in power. The system of casing ships of war in iron armour will cause battles at sea to be fought at close quarters, for the commanders of invulnerable ships (certainly in the British navy) will not amuse themselves with playing at long bowls.

This Warrior controversy has raised so many points which have an important bearing on our national defences and expenditure, that it has been allowed to occupy some space, but it is intimately connected with the subject of "Fastenings of Iron Plates," which I resume in my next letter.

A Civilian.

GIGANTIC ENGINEERING PROJECT; A SUSPENSION BRIDGE IN SOUTHERN ITALY.*

M. Adolphe Audry, *Ingéneur du corps Imperial des Ponts et Chaussées a Paris*, has proposed to unite Calabria with the island of Sicily, by means of a suspension-bridge over the Strait of Messina.

The distance across the Strait is about two miles and eight tenths, requiring for each line of the suspension-chains, one thousand six hundred feet in length, while the intervals proposed between each of the points of suspension are one thousand metres (three thousand two hundred and eighty one feet) each; width of road-bed, twenty metres (sixty six feet).

Such, then, being the main features of the undertaking, the cognomen which heads this article is fully sustained. But, inasmuch as it is only by contrast of proportions that the mind is capable of appreciating exaggerations of any kind, it may not be uninteresting cursorily to examine the subject in that light, and in doing so, it is, of course, desirable to make the comparison with other suspension bridges of the nearest cognate character. This necessarily excludes the wire suspension-bridge, first adopted in France, and subsequently introduced somewhat extensively in America, but whether successfully or not, is a mooted question, which it is not the object of this article to investigate.

It may not, however, be unimportant to observe that English engineers have generally avoided them, and that there is an undoubted practical defect in them which, from the nature of things, it is impossible entirely to overcome. For instance, it may be even admitted that steel wire can be produced of uniform cohesive strength—that is to say, that any number of pieces shall bear the same tensile strain with the same results, practically considered, without, in the least degree, diminishing the difficulties to be encountered in its application, whether mechanical or thermal; for a little reflection must show that there are difficulties from both of these causes which are absolutely insurmountable, for it is not possible that every wire shall be, at any time, under precisely the same conditions of tensile strain, even when every one of them is in a similar vertical plane. When, however, the wires are twisted into ropes as is usual, the difficulty is greatly increased.

Therefore, admitting the great skill of our engineers and artisans in overcoming difficulties of all kinds, still, however near to perfection they may arrive in some cases, it must necessarily depend so much upon the individual qualifications of so many operators, when the work to be performed is of a large dimensions, that another insurmountable obstacle to perfection is involved. To all these combined may we not attribute the loss of our trans-Atlantic cable?

The Menai suspension-bridge carries a weight of five-hundred and forty tons, the distance between the points of suspension being five hundred and sixty feet. Telford, the engineer of this bridge, had previously proposed one of a thousand feet between the points of suspension, to cross the river Mersey at Runcorn Gap; but, after his experience with the one before mentioned, he disapproved of such extended application of the principle of suspension, even if he did not disapprove of it altogether, as the practice of other eminent English engineers has done.

The *weight* of the chain itself is always an important item in the aggregate which it has to sustain; and inasmuch as that must increase with the extension of the interval of suspension, it necessarily follows that there is a point beyond which the weight of the chain itself will produce its own destruction. Any material of twice the strength of another will carry more than twice the *weight*, by at least, its own reduction therein.

Supposing, therefore, Telford's calculation to be correct, and that the application of wrought-iron to a suspension-bridge over an interval of one thousand feet, to be within perfectly safe limits, here we have one proposed of more than three times that extent, and requiring a proportionately greater strength of materials. Can this difficulty be overcome?

The French engineer, M. Audry, proposes to accomplish it by adopting, as a material for the chains and suspension rods, the most tenacious cast steel known, manufactured by the celebrated firm of Fried. Krupp, of Essen, in Rhenish Prussia. He further proposes to harden every link of the chain so as to increase its tenacity; but, as this can only be done at the expense of its toughness, which is the great *feature* of the material, and of safety in its application, we may dismiss that consideration altogether. The almost perfect homogeneousness of this cast-steel, together with its enormous resilience, far exceeding that of any other metal known, renders it the most safe in application to the purpose intended, as well as the most certain to realize the calculations of the engineer.

This is no small matter; for at least half the usual allowance made to insure safety in structures of cast and wrought-iron, is due to anticipated defects in the material itself. It is usual to allow about four times the material required, for the purpose of insuring safety, but the lowest standard of tensile strength is necessarily adopted; whereas, if the higher one were available, or perhaps even the average one, in many cases the excess of strength over that absolutely required would be six instead of four times. This is very far from exaggeration.

Now, surely, if three times the quantity of material required is allowed, to insure safety, with such a material as Krupp's cast-steel, the integrity of the structure is infinitely better secured than by any quantity of an inferior kind. If, again, we assume that this cast-steel is but twice the strength of wrought-iron, we shall need to employ but one fourth of it to insure the same or even greater security, in any case where its peculiar properties are brought into action. The reduction allowable in the weight of the chain itself is of no small importance, where, as before observed, that item forms so considerable a portion of the aggregate weight which has to be carried.

Reducing the design, as the engineer has very properly done, to its simplest elements, gives the fewest possible parts, and thus facilitates the operations of the manufacturer of the cast-steel, in the important operation of testing, with the greatest accuracy, every link up to the ultimate strain which can come upon it, according to its position in the *catenary*, which the engineer can easily calculate.

Theoretically, each chain—of which there are but two—may be considered as a single bar of steel, the cross-section of which is one hundred inches. Practically, however, it consists of a number of shafts or links, jointed together with a tongue and jaw enlargment, and a bolt passed through them. The bolt, it is presumed, will carry the suspension-rods, and thus, by the resolution of forces, insure the tensile strain, being always in the direction of the axis of the shafts or links. This mode of construction is doubtless the most simple possible, and insures the utmost accuracy of purpose, but how to accomplish it has yet to be told, for it is evident that no ordinary-sized forgings are applicable to such a purpose.

It is not intended to make any one specially responsible for the observations and calculations contained in this article, most of which are conjectural, as the designs of the engineer are not sufficiently advanced, or at least not sufficiently known, to place them in his account. All that is claimed is, that the information herein embodied comes from authentic sources, and is reliable to that extent.

The weight of the two chains, including the necessary enlargements at the joints, may be taken at seven hundred and twenty-six pounds per lineal foot, which gives eleven millions six hundred and sixteen thousand pounds as the whole weight of the two chains, each one being sixteen thousand feet long. Each link will therefore weigh thirty-six thousand three hundred pounds, if we make each chain to consist of one hundred and sixty links, and each link *one hundred feet* long.

There is nothing extraordinary in a piece of cast steel of this weight, and even four times as much would not over-test the capacity of Mr. Krupp's works, where there is a steam-hammer, the largest in the world, weighing forty tons, and having a fall of *ten* feet. "*Fritz*" is the name of this monster hammer, and "*Immer druff*" his motto; for he is always going, and hits hard.

CRYSTALLIZATION.

At the last meeting of the microscopical section of the Manchester Philosophical Society, Professor Williams in the chair, the secretary read a paper, by Mr. Thomas Davies, of Warrington, on crystallization.

Mr. Davies treats more particularly upon some of the double salts, which show beautiful combinations of form and colour by polarised light; and upon his method of obtaining determinate flower-like forms, surrounded by a film of the uncrystalised salt. The novelty of the author's system consists in the following particulars:—he makes a nearly saturated solution, say of the double sulphate of copper and magnesia; he dries rapidly a portion on a glass slide, allowing it to become so hot as to fuse the salt in its water of crystallization; there then remains an amorphous film on the hot glass. On allowing the slide to cool slowly, the particles of the salt will absorb moisture from the atmosphere, and begin to rearrange themselves on the glass, *commencing from points*. "If then placed under the microscope," says the author, "we shall see points starting up here and there, and from those centres, the crystals may be watched as they burst into blossom, and spread their petals on the plate." Starting points may be made at pleasure by touching the film with a fine needle, to enable the moisture to get under it; but this treatment renders the centres imperfect. If allowed to go on, the crystals would slowly cover the plate, or if breathed upon, they form immediately; whereas, if it is desired to preserve the flower-like forms on a plain ground, as soon as they are large enough, development is suspended, by again applying gentle heat; the crystals are then covered with balsam and thin glass, to be finished off as usual. The balsam must cover the edges of the film, or moisture will probably get under it, and crystallization go creeping on.

Many crystals which produce similar forms, cannot be preserved in balsam; in the hyposulphite of soda they are very fine, a[illegible] is endeavouring to [illegible] n it

Mr. Sidebotha[illegible]

---

* From Prussian correspondent in the *American Railway Rev*.

produced by Mr. Petschler, with bichromate of potash in gelatine, exhibited at the British Association Microscopical Soirée. Since then flower-like shapes had been obtained from nitrate of silver amongst the ramifications of the bichromate; as it is an interesting subject, he should endeavour to bring it before the next meeting.

THOMAS'S NEW PROJECTILE.

Mr. W. L. THOMAS, of Hill-street, Berkeley-square, has patented an "Improvement in Projectiles," which consists in constructing them with a leaden or other suitable soft metal jacket, which is expanded by means of an iron or other hard metal sabot in manner hereafter stated.

The shot or projectile is formed with an overhanging head and with indentations or steps at the tail end; the projectile is cylindrical, except for a small distance from the tail end, where it is by preference oval in section, it is then formed cylindrical down to its base. On the tail or rear end of the projectile is placed an iron or other hard metal sabot or cup, in the inner surface of which steps or spaces corresponding with the indentations in the shot itself are formed, the indentations are so arranged that when the cup or sabot is fitted on to the projectile, annular spaces are left between the outside of the shot and the inside of the sabot, the diameter of the shot is made equal by filling up the space between the shoulder or flange on the head and the top of the sabot with lead or other soft metal; upon the firing of the projectile the sabot is driven up on the rear end thereof, and its upper edges force the lead or other soft metal jacket up, and outwards, and cause it to be expanded into the rifling or grooves of the gun.

FIG. 1

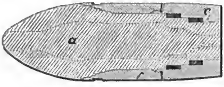


FIG. 2.

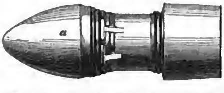
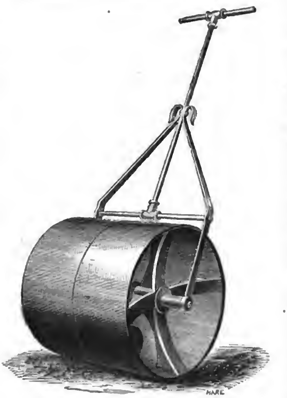


Fig. 1. represents a longitudinal section, and Fig. 2 an elevation of the same with the soft metal removed. *A* is the body of the shot made of cast iron; having irregular surfaces for holding on a leaden jacket, *C* is the iron sabot at the rear end of the shot, annular spaces are formed between the tail of the shot and the sabot; *F* is the lead or other soft metal between the sabot and the head of the shot; the space between the sabot and soft metal is filled with some lubricating material. When the projectile is to be used as a shell, a space included within the dotted lines, Fig. 1, is left in the casting for receiving the charge.

NICHOLSON'S TWO PART GARDEN ROLLER.

IN our number for November 24th, last year, we laid before our readers a description and engraving of a new horse-rake, introduced by Mr. W. N. Nicholson, of the Trent Iron Works, Newark. We now illustrate a garden roller having two cylinders or drums, by the same gentleman, which has the following advantages.—It will turn round the sharpest curves or angles, and even in its own length, without damaging or disfiguring either grass or gravel in the dampest weather. Each of the *two-parts* has the arms and bushes cast with it in one solid piece, so as to ensure great stability, and they are turned and made true at the junction by machinery, the bushes being bored at the same time, and the axles turned to fit them. The arms are so recessed as to allow space for a protecting collar with a flange (shown in the engraving), by which dirt or sand is kept from the bushes. The balance weight is a solid piece cast upon the axle, having similar flanges to protect it from any grit that may find its way through the junction of the two roller parts. The handle is made of Tubular iron, for lightness and strength.

NICHOLSON'S TWO PART GARDEN ROLLER.



ON THE RELATIVE MERITS OF THE DIFFERENT SYSTEMS OF WORKING METALLIC MINES AND COLLIERIES.

BY H. C. SALMON, F.G.S., F.C.S.

(*Concluded from page 162.*)

In collieries, as everyone knows, the workmen are lowered and raised by the same means as the coal is raised. In metallic mines, on the other hand, except in a few where "man engines" are in use, the men have to descend and ascend by ladders. The waste of labour which this involves in deep mines—mines from 150 to 300 fathoms deep—is enormous, leaving out of the question the injurious effect it has upon the health. There is, I believe, no possible labour to which a man can be put more exhausting to the system than the climbing of a deep mine by ladders. In fact, nothing but habit could enable a man to do it. For depths of 100 or 150 fathoms, the task is not a serious one to a person accustomed to climbing, but depths of 200 or 300 fathoms are trying to the strongest men. The task of climbing from the bottom of Wheal Vor, for instance, a depth of 323 fathoms from the surface, is really, for the labour expended, only to be compared to scaling some Alpine mountain, and to place such a task before a man after a day's work is clearly preposterous. As a matter of fact, in the deep Cornish mines not provided with man engines, only young, and consequently inexperienced, men can be found to work in the very deep parts. Experienced men—experienced as workmen, and also experienced as to the necessity of husbanding their strength, and not wasting it wantonly like boys—cannot be got to work in very deep places, at least if times are at all good and work plentiful.

But while one admits the evil, it is not so easy to suggest a remedy. Where the circumstances admit, or justify the employment of man-engines, they are employed, but yet there are not above eight or nine of them in the kingdom. The great desideratum would be to employ the same means as are used for raising the ore, and many schemes of this kind have been suggested, called "safety skips." There is a feeling among many agents in Cornwall that such machines might, with a reasonable degree of safety, be employed. But none have yet dared to incur the responsibility of adopting one, for if a serious accident were to occur, and the public mind became excited, a manager who adopted an innovation of this kind might find himself in a very serious position.

VENTILATION OF MINES.—The air in mines, of whatever nature, soon becomes vitiated from various causes. The vitiation, however, principally arises from causes which may be classed in two categories: the subtraction of a portion of its oxygen by the respiration of the workmen, and the combustion of the lamps or candles; and the introduction and mixture of other gases discharged from the cavities of the neighbouring rocks, or arising from the decomposition of contiguous substances. In the case of metallic mines generally, the vitiation of the air is due almost entirely to causes of the first category—that is, the subtraction of the oxygen by respiration and combustion, coupled with the intermixture of any gases arising from the gunpowder used in blasting. In certain cases the air of metallic mines is corrupted by other causes, but these are exceptional, and speaking generally, one may say that, except in a very minor degree, the vitiation of the air of metallic mines is due entirely to the abstraction of the oxygen by respiration and combustion—just as the air of this room would become vitiated from similar causes.

With the combustible minerals, particularly coal, the case is very different. The same causes which vitiate the air of metallic mines are also in action here, abstracting the oxygen but to these are added causes of the second category, arising from the introduction and mixture of other gases produced from coal, of a much more dangerous character. The principal of these gases are:—

Carburetted hydrogen, or "fire-damp," so fatally dangerous from its explosiveness. When mixed with atmospheric air in a less proportion than one-thirtieth, no effect is observable. When mixed with air in a proportion varying from one-thirtieth to one-fifteenth, the flame of a candle or lamp, lengthens and enlarges in proportion to the quantity of gas present. Those experienced in the matter can judge pretty accurately of the quantity of gas present by the state of the flame, and suspected workings are "tried for fire-damp" by this means. When the proportion of gas reaches one-fourteenth, the flame will propagate itself, but without any violent explosion Above this point, the inflammability of the gas increases rapidly, up to between one-ninth and one-eighth, in which proportion the mixture arrives at its maximum explosive power. As the proportion of fire-damp increases beyond one-eighth, the mixture becomes less and less explosive until it reaches one-third, at which point it ceases to fire, and extinguishes the lamp. This gas is not in itself poisonous or destructive of life, unless where it occurs in such considerable quantities as [illegible] to leave sufficient atmospheric air to supply the oxygen necessary for respiration.

Carbonic oxide is a gas even more highly explosive than fire-damp, and, unlike the latter, is poisonous and fatal to life in the highest degree. There can be little doubt that this terrible gas has caused a much greater loss of life than is generally supposed, by poisoning suffocation, it being calculated that 1 per cent. is fatal to animal life. The common notion, founded on the experience of carbonic acid gas, that where a flame exists life is also safe, does not apply to it, for in certain mixtures with atmospheric air a flame will burn without explosion, yet life be instantly destroyed. Mr. Dickinson, the Government Inspector of the Manchester district, mentioned a case which occurred two years ago, within his own knowledge, in South Wales, where a large number of men and boys were killed with lamps and candles burning in their hands, by gas which caused no explosion. He also mentioned a case where he himself helped to carry two men out of gas when their safety lamps were burning. Poisoning suffocation of this kind may, however, also be due to sulphuretted hydrogen, another highly poisonous gas.

Carbonic acid gas, or "choke-damp," forms in very class of mines as a result of respiration, combustion, and the blasting of powder. In coal nines especially, however, its great danger is as a esultant from the explosion of the fiery gases lready named. Many, in numerous instances, nly escape the explosion to be suffocated by chokeamp. When atmospheric air contains upwards of per cent. of the gas, it becomes dangerous to uman life. As the effect of this gas on the stem is to a certain extent poisonous, its presence, ill-ventilated mines, gradually undermines the onstitution, even when in quantities so small as exclude all danger of suffocation.

Such are the enemies with which miners have to ntend. In the case of metallic miners the ngers are less striking, although for that very ason they may be more insidious; for there bad ntilation only kills gradually, and the minenager has no apprehension of an explosion which y draw upon him the scrutinising eyes of the gdom in no very friendly spirit. But the ition of a colliery—particularly one with a fiery m—is one of constant danger and anxiety, at time liable to a terrible accident which no one guard against. As an instance of the terrible losive power which may be generated by the duction of these gases from apparently insignint quantities of mineral, I may mention the of the Hetton Colliery explosion, which was of extraordinary violence. Mr. J. L. Bell nated that the quantity of gas which caused which, from peculiar circumstances, was ascerable) might, if carburetted hydrogen, be gened from 152 lbs. of coal—or, if carbonic oxide, 49 lbs. of coke. He added, that the explosive of this quantity of either gas would be equal bout 75 quarter-barrels of gunpowder, each l being 25 lbs. This may help those unacated with the subject to realise the extent of xplosive matter hoarded up in our coal seams. e general principles upon which the ventilaof all mines is carried out are essentially the as those with which we are familiar in the lation of public buildings. They all rest on ell-known doctrine, that as we heat air we its specific weight, or, in popular terms, we it, so that it will ascend and replace the air above it, and *vice versa*. As the tempe of the rocks, at a small depth below the e, is not affected by the atmospheric variaof temperature, it follows that in winter they rmer and in summer colder than the atmosair, and the consequence is, that if a mine vo openings, one more elevated than the a natural circulation will arise by which in the air will enter at the lower and escape higher opening, and in summer enter by gher opening and escape by the lower one. ould be the case if the temperature of the vere the same in every part, but in a mine s working this would never be the case, and, consequently, if even there were no difference between the levels of the two openings, currents would be created, and a natural ventilation result. In the case of metallic mines it is only necessary to open out the ground by levels and winzes to create this natural ventilation, which experience has proved to be the best of all others. As the movements of the air caused by variations of temperature take place in a vertical plane, metallic lodes—being approximately vertical—easily maintain a natural ventilation. Sometimes in mines of this character, particularly in driving long levels upon which an air-shaft cannot be sunk, recourse is had to artificial ventilation, but in good mining this is only regarded as a temporary expedient, the end and aim of good management being to open out the mine as soon as possible, so as to get a natural ventilation. In driving long levels with but one air-shaft, a mode of ventilation is sometimes resorted to, as shown by the drawing. The bottom of the level is covered with an air-tight "sollar," which extends nearly up to the forebreast of the level, and between the mouth of the level and the air-shaft an air-tight door is placed. The air in the level, heated by the combustion, &c., rises up the shaft and escapes, being replaced by fresh air, coming in under the sollar, and passing in front of the forebreast. If there were no sollar, the heated air would equally rise in the air-shaft, but then the current of fresh air coming in through the level would not have extended beyond this shaft, and would, consequently, not have aided in ventilating the forebreast of the level.

Although the natural circulation of the air, arising from the cause I have mentioned, is sufficient for effective ventilation in the case of metallic mines, it is not so in the case of the generality of colliery workings. The openings for the purpose of "cutting out" the coal being, generally speaking, made in a plane more or less horizontal, there evidently is no possibility of having the same natural ventilation as in the case of metallic mines opened out in an approximately vertical plane. Consequently, there must be artifical means of stimulating the circulation of air.

The Furnace.—The natural circulation of air in mines being influenced by differences of temperature, the most obvious mode of stimulating this circulation would be by increasing these differences artificially. If in the case of the air-sollar, already described, a fire were placed at the bottom of the air-shaft, it is evident that the circulation would be stimulated enormously, and in proportion to the depth of the shaft. This is the principle carried out in the ventilation of collieries when a furnace is employed. Distinct modes of exit and entrance for the air having been arranged, either by means of two separate shafts or by one shaft divided into two air-tight compartments by a brattice, the furnace is placed at, or as near as convenient to, the bottom of the shaft through which the air-current is to ascend, or the "up-cast shaft," as it is called. The impure air which is withdrawn from the workings by this "up-cast" shaft, is replaced by pure air from the atmosphere, which descends through the other, or "down-cast" shaft. The mode in which these furnaces are sometimes placed in the mine is shown by the drawing. I need scarcely say that the details of their arrangement, so as to cause as little inconvenience as possible at the bottom of the shaft, and to insure their being fed by air free from explosive gases, are various in the extreme, and require the exercise of the greatest judgment.

Mechanical Means.—The other mode of artificially stimulating ventilation consists of the application of mechanical means for drawing out the air. The machines hitherto used for this purpose have been of two kinds, one being essentially an air-pump, and the other a centrifugal fan. Time will not permit me to enter into the respective merits of these different contrivances; but, with regard to the respective merits of the furnace and mechanical appliances of any kind, I may state that the mining world is much divided on the question. For shallow pits mechanical means are, undoubtedly, better, although, like most things in this world, they present various practical difficulties.

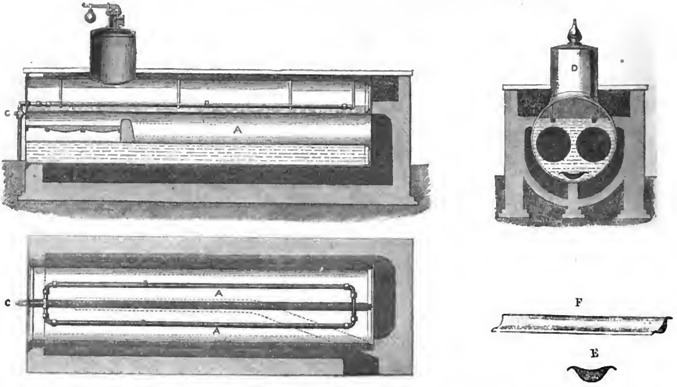
The ventilating current being produced by either of these means, it remains to regulate it, and distribute it through the workings so as most effectively to remove and dilute the noxious gases. It would take a volume to discuss, even in a general manner, the problems which are involved in carrying out this operation. The rate at which the currents should be made to pass—the area and extent of the air-courses and their resistances—the splitting of the currents, by which the quantity and quality of the air is improved, and the different divisions of the mine to a certain extent isolated, so as to minimise the danger in case of an explosion in any one division—are some of the most important. The drawing will give some notion how these matters are carried out in their simplest form.

Another principle of ventilation, which is as old as mining, and which has always been more or less practised, is to drive fresh air into the remote workings, instead of drawing out the vitiated air. There are circumstances where this may be usefully practised, but it has been demonstrated over and over again, that it is attended with great loss of power, from the well-known laws of pneumatics.

I have thus endeavoured, rather discursively I am aware, to give a general notion of the leading conditions affecting the working of mines. That they are conditions attended with enormous complications and difficulties, I think every one must admit; and that consequently those who carry out the working of mines are entitled to a reasonable amount of forbearance and consideration. Of every class engaged in industrial pursuits, mine owners are the most liable to casualties and accidents, against which no foresight or prudence can provide. They are liable to equal, if not greater risks, than the shipowner, without his power of insurance. To them serious accidents frequently mean ruin, and consequently it is absurd to suppose, as some seem to do, that mine owners are indifferent, if not callous, to accidents. It is undoubtedly the duty of the Government to interfere to protect those who are liable to great dangers; and in most countries indeed it is held that the mineral property of a nation, being of an exceptional character—being a capital which once consumed can never be supplied—should be entirely administered by the State. However much such a notion may now seen repugnant to our ideas, it is by no means improbable, in certain districts at least, that some such arrangement must be ultimately resorted to. The majority of our collieries are worked on short leases, and under such circumstances it is unreasonable to expect works to be carried out in the style of those of a railway company. The building-leas system of London does not encourage a very permanent class of erections, so what can be expected in the case of twenty-one years' leases? Many landowners care little about the prospects of prosperity, but make such arrangements as will ensure the largest present income—and lessees must act accordingly. If foreign Governments interfere incessantly with the working of mines, at least they protect them from grasping terms, which can only be complied with by a system of working injurious to the future; and they give a security for the investment of adequate capital, by insuring a continuance of a concession as long as certain defined terms are complied with. I have no objection to see Government interference, in the case of mines, largely increased; but I am satisfied it can only be usefully done by beginning at the beginning.

At a recent meeting of the Microscopical Section of the Manchester Philosophical Society, Mr. Edward Lund exhibited two forms of stands for holding a microscope, condenser, lamp, &c., one in the form of a tray, fixed on four castors, to run upon an ordinary table, and the other a small turn-table, thirty inches high and fifteen inches diameter. The lamps were for paraffine oil, fitting into wooden cups secured to the stands.

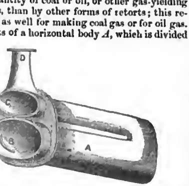
ATTWOOD'S SURFACE SCUM-PLATE AND CONDUIT.



THE FITZMAURICE GAS RETORT.*

Our readers have heard of the Fitzmaurice Gas Light, which we understand only differs from other gas lights by the gas being made of a richer and pure quality, and at a less degree of heat by the above-shaped retort.

The quantity of gas extracted is greater from a given quantity of coal or oil, or other gas-yielding materials, than by other forms of retorts; this retort acts as well for making coal gas or for oil gas. It consists of a horizontal body *A*, which is divided into two chambers *B* and *C*, *between* which bodies there is a way for the heat, which is thus enabled to reach the centre, and act upon the gas-making materials at once. As the heat is thus more uniformly directed and diffused, the gas is extracted from the coal, &c., before the sulphur in the coke is materially disturbed, and the hydrocarbon vapours which quickly arise from coal, or from oil, when entered into a heated retort are well acted upon in the upper chamber *C*, and before passing out form gas, instead of being allowed to escape and recondense, after passing *D*, so much as hitherto. The combined or double action of this retort, and the advantages arising from its use are thus apparent.



We understand that from the success of the invention, which has caused it to be largely used in lighting by gas many of the principal mansions in England (a 400-light Gas Works having been fitted at Newstead Abbey, the late Lord Byron's residence), orders are being executed at the Fitzmaurice Works, St. John Square, for the purpose of fitting works on board, to light by gas the large ships of the navy.

---

* Copcutt's patent.

ATTWOOD'S SURFACE SCUM-PLATE AND CONDUIT, FOR STEAM BOILERS.

It is a well-known fact, that most of the impurities contained in water will, when in a state of ebullition, rise to the surface, and there remain until it becomes more dense than the water, when, it sinks or clings to the sides of the boiler, and in all cases to the parts where the heat is greatest; witness the back tube plate of a multitubular boiler, which invariably goes first. The scum-plate and conduit, introduced by Mr. H. Attwood, of Wapping Wall, and illustrated in the accompanying engraving, is shown applied to a boiler.

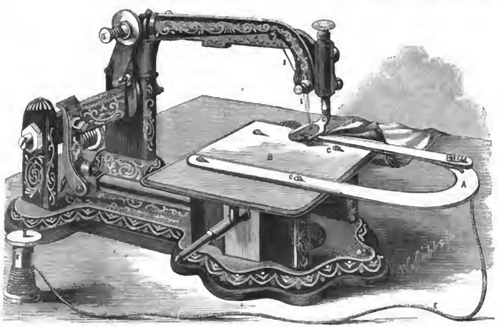
The scum-plate and conduit are for the purpose of receiving all impur ties floating on the surface of the water during boiling. *A* represents the boiler, *B* the scum-plate and conduit, *C* draw-off cock, *D* steam-chest, *E* shows an end view of a dished conduit. *F* plan of the same. It is preferred to place the dished conduit at the bottom of the boiler; the upper part of the apparatus is perforated for dirt and other impurities to pass through. The upper one is fixed at the water line, so that the impurities or scum may overflow and be carried away by the pipe and cock *C*. A similar arrangement is also made for the bottom of the boiler, for the purpose of blowing out the sediment. This apparatus, with the occasional aid of a chemical, to cause the water to ferment and throw up its impurities to the fullest exent, will prevent incrustation, and of course preserve the boiler.

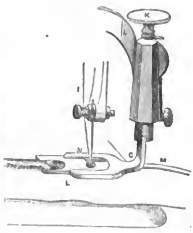
The *Times* says among the number of Armstrong guns subjected to proof, on Wednesday last, at the Royal Arsenal butt, Woolwich, three 100-pounder naval guns, to be denominated henceforth 110-pounders, were considerably damaged, and were returned to the forge. The defects were similar in each gun—namely, a separation of the coils forming the breech part, which yielded so as to disable the guns from further use in their present state.

RECENT IMPROVEMENTS IN THE SEWING MACHINE.

Some most important improvements have lately been effected in the sewing machine, by the firm of Wheeler & Wilson, of 139 Regent Street, and we attach an illustration of one of the most recent manufacture, combining the most approved alterations. The radical operation of the machine has not been changed since its first introduction to the public, but most valuable attachments have been added from time to time. One of these attachments, the corder, is used for laying cord on shirt-fronts, collars, vests, coats and ladies' clothing. The corder *A* is attached to the cloth-plate *B* by the screw *CC*, so that the end of the tube *D* shall come in a line with the stitching. The cord *E* is passed through the guides upon the corder and through the tube *D* far enough to hold. The fabric *F* to be corded is placed so that the tube *D* shall deliver the cord between the folds where the cord is to be laid, and the stitching is done as usual. Another elegant as well as useful addition is the crystal cloth presser and the new mode of adjusting the hemmer. The ordinary cloth presser was entirely of metal, but Messrs. Wheeler & Wilson have recently introduced a slab of glass into the foot *H*, which enables the operator to watch the progress of the work, and the hemmer *N*, Fig 2, can be substituted for the glass in a moment. The hemmer is the most ingenious and valuable attachment yet made. It consists of a small piece of metal convoluted and adjusted that it turns the material over for the hem and passes forward to the needle where it is stitched in the ordinary manner. Fells and hems of any width and of any curve are readily and beautifully made, far superior to hand sewing. Numerous other alterations have been effected, rendering the machine generally useful, and abolishing the noise, so great an objection in the earlier machines, and substituting only a musical "click, click," which is more pleasant than otherwise. We are glad to learn that the machines are finding their way so extensively into private families, and that numbers of the "upper ten thousand" have already visited Messrs. Wheeler & Wilson's show rooms and purchased their elegant machines, and we do not doubt but that

RECENT IMPROVEMENTS IN THE SEWING MACHINE.





very few years a sewing machine will be con- ·ed a necessity in every household. Every proves them to be of the utmost value to the stress, as they substitute a healthy employ- for an unhealthy drudgery, at the same time the operator obtains a greater recompense er labour. We have been surprised at the ·y of work which Messrs. Wheeler & Co's. titch sewing machine will effect; the finest n or the thickest cloth, even leather, all are ered by the persevering needle, and the s said to be far stronger than hand sewing, gh the speed varies from 600 to 2,000 stitches nute.

have been informed that Messrs. Wheeler & 's establishment is capable of turning out 0,000 to 70,000 machines per annum.

THE ARMSTRONG GUN.

PTAIN HALSTED'S REPLY.—PART II.

THE RELIABILITY OF SIR WILLIAM ARMSTRONG'S REPLY.

(*Continued from page 163.*)

after three years of prodigal aid lavished in ·y we have now traced our paid national in- his present anxious occupation of preparing the core of his barrel, working at a new com- r his breech, and trying how a fresh metal r effect a safe junction between the two. we may gain a still clearer insight as to any dence of his own in his own work, let us see s exhibited by the following *resumé* of still facts" which those three years have pro- . :—

original "Multigroove" family with screw- have as follows:—

-pounder on the "solid forging" plan pro- be "inferior."

)-pounder on the "coil system" pronounced erior."

h in about equal numbers; but the real nence of the merits of either depending on t experiments of tapered inner tubes on oil system," and gun-metal inner tubes on lid "forging plan." Such experiments g—not the inventor's confidence, I submit his dissatisfaction with both modes of con- on alike.

ounder found too weak, and withdrawn.

ounder according to strengthened con-

ounder according to new construction.

rter and stronger description of gun in all portions now under manufacture for the ae, and, as I believe, not yet proved. Un- ined if it shall have the screw-breech of ultigroove" or the wedge-breech of the ."

6th. 25-pounder, specially designed for naval-boat service, but withdrawn, known when in existence as "long" 25-pounder.

7th. 20-pounder, known as "short" 25-pounder, designed as substitute for the former, and made to consume its ammunition.

> Besides these, there was much loud talk at one time of a 300-pounder, supposed to belong to this family; recently the papers have again noticed it. Will it be rifled at all, or will it remain a smooth-bore?

Of the second-born, or "Shunt" family, we have, or have had, as follows:—

8th. 68-pounder shunt, muzzle-loading.

> Specially intended for the navy, entirely failed. Plan and contract alike given up.

9th. 32-pounder shunt, muzzle-loading.

> Proof sample burst at 45th round in competitive trials at Shoeburyness in September last. Other samples are believed to be constructing.

10th. 120-pounder shunt, muzzle-loading.

> Proof sample loudly praised at Shoeburyness. Recently returned to Woolwich with grooving worn half down. New sample or samples under construction, but of harder material, it is believed from the Mersey Iron Works.

11th. 120-pounder or 100-pounder shunt, breech-loading, with double-wedge breech.

> Proof sample found at Shoeburyness to jamb its breech. After alteration, the front plate of its breech is reported to have broken on proof more than once. Since made some very rapid firing at Woolwich with intervals of cessation, the longest continuation being 21 rounds. No account as yet of any repetition of this practice, nor any at the time of its effect on the gun. I am informed, however, that the "cups" had to be changed during the performance, and that the copper breech-ring has since been replaced by iron. This is the gun which has cost "two years of study." It may be used alike as a muzzle or a breech-loader, and has been fostered, with the view of supplanting the large "Multigroove," being so introduced in May last at the Institution of Civil Engineers. In this family the principles of construction, of rifling, and of the breech differ essentially throughout, and in many cases are the reverse of those which characterise the "Multigroove."

Of the third-born, or Composite family, we have as yet—

12th. 70-pounder breech-loader.—An entirely new description of gun. The rifling of the barrel is modified from that of the "Multigroove," and instead of the screw-breech of that family, it has the wedge-breech of the "Shunt."

> This gun is loudly bepraised beforehand, and if it can be made to stand proof, it is supposed that, under a plea of superiority, it will be substituted for both the "multigroove" and "shunt," out of which it is compounded. The present 100-pounder will then most probably pass into limbo, as in the similar substitution of the 25-pounder by the 20-pounder boat-gun. The first specimen, when recently put to proof, broke the front-plate of its wedge-breech, I am told, at the first shot, and has, I believe, repeated the performance.
>
> These three families, with their twelve varieties, are limited to naval guns only.

To which, then, of all these "broad facts" will the inventor himself point as evidence of his own confidence that his work is producing for us a true system of rifled artillery? Is the state of things I have thus endeavoured to put together the proof of any system at all; or is it not rather an evidence of nothing but confusion? Is it practical science at all, for the undisturbed prosecution of which our prolific inventor so feelingly pleads, or is it not rather a full specimen of that practice in which a well-meaning gentleman of talent and address begins, innocently enough, by deluding himself into the idea that great powers of ingenuity can be made to compensate for great unsoundness of principle, until, by forced and seeming success, he becomes a first-rate practitioner of this same delusion upon others? Quite irrespective, then, of all changes of breech, breech-ring, or barral, are not these changes of radical plan and principle in the guns themselves a manifest proof that the pilot to whom we have committed ourselves in this matter is himself, without chart or compass, utterly "at sea," unable to point to where he is; where going; or by what means he hopes to get anywhere at all; while all the time loudly demanding from all who will give it a blind worship of that idol, every distinctive feature of which he is thus alternately marring and remoulding with his own hands, as fresh ideas or perplexities arise?

I now refer, as briefly as is right to do, to the fatal practical truths elicited by the September trials on board the Trusty.

I accept the writer's charge of "carelessness," by which alone he accounts for the results which then took place; but I add, that until means be found of making men more careful still, such results must, on real service become still more certain, more frequent, and more serious. The firing itself of the 143 rounds occupied seven days, a mean rate of ten per day for each gun. The highest number fired on any day from both guns was 44 rounds, and the highest fired by either gun continuously was 12 in the one case, and 10 in the other; in all of which there is scarcely an approach to the stress these guns must have endured, had they been able, if really engaged in action.

In order to provide against default in the experiment itself by any default in the men, when the two guns' crews were applied for to the Excellent, request was made that they should be thoroughly instructed in the practice of the Armstrong; and an equally select officer was sent to direct them. The cupola itself is an invention specially designed to elicit the merits o this gun, and the superior officer over all was its warm admirer. When it was proposed to work the gun in the cupola against the gun on the main deck simultaneously, the objection urged was that the men would get excited, and omit some of the important minutiæ of their instruction; and the plan of working the two guns and crews alternately against time, was adopted, purposely to enable complete supervision to be exercised over the performance of these minutiæ; which were so rigidly exacted, that at one time it was felt by Captain Coles that the rate of firing from his cupola was unfairly hindered by them. The superior artificer despatched from Woolwich to repair the accidents witnessed the fate of eight, I think, out of the twelve breeches destroyed, without a remark as to carelessness, or a notice beyond recognition, that, whether of iron or steel, both descriptions of breech were incapable of sustaining the work.

The writer attempts to support his charge of "carelessness" by the fact that the gun which chanced to break most of the breeches was afterwards brought to Woolwich, and in fifty-eight rounds broke none, a proof, as he regards it, that such wholesale destruction was in some mysterious way "localized" to the Trusty. This localization I also accept, but again, with the addition that a similar locality will undoubtedly be found in every ship where these guns are subjected to an equally honest representation of fight. That representation took place very openly, and among all who were present I doubt if the writer could name one who was not more or less friendly to his gun; and if any of those, of whatever rank, who are thus reflected on by this charge of a "localised result," had in turn been invited to witness at Woolwich the firing of those fifty-eight rounds, there can be as little doubt that they would have had no difficulty in discovering that difference of practice which there produced the "localised result," also of not a breech being broken.

The first interruption to the experiment was by one of those compound disasters in which the breech on breaking jambed itself into the barrel, from which it was impracticable to extract it by any means then present, and when subsequently removed, the breech-ring was found also to be destroyed, and had to be renewed; the whole operation occupying three days by the party sent from Woolwich for the purpose. The second interruption was from a similar compound casualty, but not so severe. The third interruption was from the necessity of only refacing a breech-ring, also injured by the destruction of a breech.

Captain Coles's summary of this first *quasi* naval action with Armstrong 40-pounders is as follows:

"During these trials, twelve 40-pounder "vent-pieces," *i. e.* breeches, were cracked, six of iron and six of steel, in 143 rounds; and three guns disabled, till put in order by an artificer from the arsenal."

It would be quite justifiable, and by no means difficult, were I now, in conclusion, to exhibit in verbal portraiture the self-produced casualties thus inevitably attendant on a prolonged action—if such could be—in the case, say, of a frigate with a main-deck battery of Armstrongs. On the principle that like causes produce like effects, I should but have to mix my colours out of the many disastrous effects arising from the several incapabilities and liabilities of the gun which these pages have shown; and a far less frequent exhibition of each than occurred in the Trusty, under instructed gunners and a selected officer, would suffice to paint a forcible picture. Barrels would furnish incidents, from flaws, from cracks, from stretchings, from strippings, and from ill-applied dumb-bell cartridges. Breeches would furnish theirs from burstings, from breakings, from blowings away, from jambings, and from their many modes of less mischievous expenditure, till the crisis came of the spare stock being expended altogether. Breech-screws would show the results of their becoming injured from the breaking of breeches, the breaking of threads, the hollowing of their surfaces from lubrication too little and too much, from dirt-jambing, from stiffness when in use, and from the necessity of being withdrawn for cleaning throughout, in order to be used at all. Breech-rings would supply their quota from refacings and replacings, if either operation were possible when in action. Then there would be that incurable "escape of gas," with its stifling stench, imparted by the improved Boxer composition. Then the inefficacy of the lubricator itself from long keeping, or the result of its total expenditure. Then the wounding fragments from the tin and copper "cups." In short, the fullest picture of a naval battle, with Armstrongs, would afford no room for even one incident each, producible from those many liabilities which have occurred many times more than once, before the first naval Armstrong has seen any battle at all. The whole to wind up with the efforts to escape from capture,—if an unprotected screw and steerage gear still remained available for the purpose;—but in any case with the unmistakeable anger and indignation of a British crew and officers for the first time in naval history—betrayed by their guns.

But, however easy to paint a picture with means so ample, I feel that to do so might unnecessarily subject me to misrepresentation. Moreover, with such of my professional brethren as may have favoured me with their company thus far, each for himself may paint his own picture out of the materials thus ranged in summary for his use. And those not professional may see proof, I trust, in the abundance of this material, that the misgivings which these pages confess are both well grounded, and present a fair claim for support in procuring that inquiry for which alone they have been written. I will not even despair of seeing such effect upon the great leader of the press,—not as any *amende* to so unnecessary a unit in the community as the author of any pamphlet whatever, but as due to public opinion expressed in the *Times* of the 9th of October last, by its now resuming that advocacy for inquiry which furnishes the motto I still stand by; and for any temporary suspension of which there can be no doubt of its ability to put forth a full and acceptable explanation.

That some keen official scrutineer, well-drilled to his lesson, and with all means at his command, should detect in these pages unknown and unintentional inaccuracies, is, from the circumstances under which they are written, a natural necessity; and to all who might thereupon challenge them, I here reply, "Place at my disposal, also, the complete information to be furnished by Elswick and Woolwich, and there shall be no complaint against either the fulness or the accuracy with which I will support my facts." But as I have no intention of leading a life of controversy, so every challenge will be unheeded, unless it prove me to have occasioned some specific but unintended injury or offence. I know how proverbially ungrateful is the task of attempting to open unwilling eyes, or to disturb a self-pleasing, but false tranquility, and that such a task may be pronounced presumptuous as well as difficult when undertaken against such heavy odds as are before myself. But, confident in the truths I have seen and learned, I have felt that if such attempt be made at all, far better and more faithful to make it now than await until catastrophe itself enlightens us all. I have had, therefore, no alternative between self-reproach and the performance of duty, and that duty to the best of my ability, I am very happy to say, I have now, upon my part, finally performed.

MEETINGS FOR THE WEEK.

Mon.—*London Inst.*, "On the Instrumental Music of the Opera, and its Influence on Vocal Music," by J. Pittman, Esq., at 7 p.m.

United Service Inst., "On the War in New Zealand," by Captain C. Paisley, R.E., at 8.30 p.m.

Medical Soc., Clinical Discussion at 8.30 p.m.

British Architects, "On Pictorial Mosaic as an Architectural Embellishment," by M. Digby Wyatt, V.P., at 8 p.m.

Tues.—*Royal Inst.*, "On Light, and the Special Organs and Sense of Sight in Man and Animals," by J. Marshall, Esq., F.R.S. at 3 p.m.

Inst. Civil Engineers, I. Discussion upon Mr. Hartley's paper "On the Lower Danube." II. "Description of Works at the ports of Swansea, Silloth, and Blyth," by J. Abernethy, Esq., at 8 p.m.

Ethnological Soc., I. "On the Ancient Indian Tombs of Chiriqui in Veragua, on the Isthmus of Darien," by H. Bollaert, Esq. II. "Note on the Stone Celts from Chiriqui," by Carter Blake, Esq.

Wed.—*Society of Arts*, "On the Sewerage of Towns," by Robert Rawlinson, C.E., Sanitary Commissioner in the Crimea, at 8 p.m.

London Inst., "On the Seven Metals of the Ancients, their Chemical History and Applications," by F. Field, Esq., F.R.S.E., &c., at 7 p.m.

Thur.—*Royal Soc.*, at 8.30 p.m.

Soc. for the Encouragement of the Fine Arts, "On the Piano-Forte: Its Uses and Abuses," at 8 p.m.

Antiquaries, at 8.30 p.m.

Royal Inst., "On Heat," by John Tyndall, Esq., F.R.S., at 3 p.m.

Linnean Soc., at 8 p.m.

Fri.—*London Inst.*, "On the Classification, Properties, and Uses of Plants," by Robert Bentley, Esq., F.L.S., at 7 p.m.

Royal Inst., "On Some of the Causes, Effects, and Military Applications of Explosions," by F. A. Abel, Esq., at 8 p.m.

United Service Inst., "Geodesy, especially relating to the Great Trigonometrical Survey of India," by Major Strange, at 3 p.m.

Royal Inst., "On National Music," by H. F. Chorley, Esq., at 3 p.m.

TO CORRESPONDENTS.

Received.—J. B. M., R. B., Capt. N., J. W., S. P., S. T., R. G., G. S., E. E. S., J. H. D., P. D., R. A. E. S., T. W., J. H., W. R., Engineer, W. D., T. R. S., Artillerist, W. B., J. T. W., W. W., R. P. E., Anti-Armstrong, A. B. C., Enquirer, J. H., W. F., J. H., Bristol, the models have not arrived.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

A PROPOSAL FOR THE VENTILATION OF COAL MINES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—It has been matter of observation for more than a century, I believe, that explosions in coal mines are apt to follow upon a fall of the barometer, and the reason is obvious, because both the generation and the evolution of coal gas are facilitated by a diminution of the previous pressure in the passages of the mine. Hence, at first sight it appears to be wrong practice to create a *current* of air through a pit, by means of a furnace, or of a steam jet, acting on the column of air in the upcast shaft, inasmuch as a less than atmospheric pressure is thus maintained on the immense surface of coal through all the works, with the effect of eliciting instead of repressing the production of gas, and with the effect more especially of favouring its escape into the passages of the mine, instead of compelling its exit, in part, or in the entire, as the case may be, by any natural outlets which may exist. The corrective expedient would appear to be the opposite course, of maintaining a greater than atmospheric pressure in the pit, by forcing air into it, instead of exhausting air from it; and this plan I would have proposed many years since in your pages, but that I have always conceived that the mechanical and other practical difficulties in the way of it must have been very great, or that it would long since have been adopted. It seems, however, that lately, in a few instances, mechanical means (a fan, I believe) have been resorted to with great success in exhausting the air from pits, and therefore I am disposed to inquire why, with a slight alteration in the appliances, these means have not preferentially been employed in compressing and sending a current of *dense* air through the pit? What are the objections? Possibly these: that no practical increase in the pressure of air can prevent the generation of coal gas; that though the gas might be driven back for a time into the fissures of the coal, and also be condensed in the interstices thereof,—its tension by accumulation would soon be equal to that pressure, when it would ooze out into the passages of the mine as freely as before; that, in fact, a dangerous reservoir of gas would be created ever ready, on any diminution of pressure, to burst out in greater quantities, and with far more disastrous effects, than ordinarily result from the ordinary diminutions, consequent on the more usual atmospheric variations.*

I believe that this reasoning would be just, in all cases, at least, where the natural outlets for gas are not free and abundant; and even there, in reference to such condensations of gas as could not find other discharge than into the passages of the mine. At the same time, does not the greater danger thus created itself suggest the remedy? Does it not direct us to a mode of ventilation which would make our coal pits—shall I say absolutely safe?—at least comparatively safe, as safe as the nature of things will permit? Allow, then, the accumulated gas to have free vent—let it exhaust itself at intervals, as frequent and for so long a time as experience shall determine to be necessary for safety for each particular mine, at which time there should be a cessation of work, safety lamps notwithstanding. Let this process be facilitated, not merely by a stoppage of the positive pressure, but by a diminution of the pressure below that of the atmosphere, to be effected by a reversal of the action of the air engine, and by the consequent production of an exhaust current of air, sweeping away all the gas given out. A return to the compression current of air, by another reversal of the action, would check the generation of gas, force it back into the fissures and interstices of the coal, complete the sweeping of it out of the passages, and maintain them *entirely* free of it for a length of time, depending on conditions special

---

* Is it not for this reason a dangerous practice to wall out old workings? Must not the gas increase in tension until perforce it escapes somewhere or other, and in most cases into the pit, although in an insensible manner through numerous porous conduits, perhaps; and yet on the occasion of a diminution of atmospheric pressure, would it not be extricated in much greater quantities, by reason of its density and force, than would have been the case in similar times, if the whole area had been thrown open?

Digitized by Google

to the character of the particular mine. Gas would then begin to show itself, and increase in quantity gradually, but not to a dangerous degree, during the permitted period of work. In many mines it may not show itself at all during an eight hour relay. Indeed, a permanent current of this kind would not permit danger to arise more readily than an exhaust current; it would, of course, be quite as effectual for simply clearing away the gas, but under its constant use, accidents would be more likely to occur than under the constant use of the other. The alternations I propose, in addition to rendering the mine ordinarily more safe under the use of naked lights, would strike at the source of these accidents, due, for the most part, to variations of pressure; for the artificial difference of pressure, by reason of its opposite action and greater intensity, would over-ride and render harmless the natural differences due to atmospheric changes.

It is to be understood that the reversing of the action of the air-engine, would not imply the reversal of the current of air. The alternations would consist, in at one time drawing air from the up-cast shaft, and forcing it into the atmosphere; and at another time in drawing air from the atmosphere, and forcing it into the down-cast shaft. The current would be always moving in the same direction; the only change would be in its state, as a plus or as a minus pressure in reference to that of the atmosphere. At the commencement, indeed, of a change of these states, from either to the other, there would be an increase in the celerity of the current, because, for a short time, there would be an increase in the difference between the pressures at the tops of the up-cast and down-cast shafts. Therefore, in respect even to a continuous working of a pit, there would, I conceive, be no greater delay, arising from the introduction of the minor pressure into the current, and its continuance for the proper time, than is caused by carrying out the relays of the men, when the opportunity would be taken to effect the change. The men would assemble and be perfectly safe in the neighbourhood of the down-cast shaft. In extreme cases, however, and under a system of naked lights, which it is so desirable, if possible, to introduce, it is not improbable that the alternations would require to be more frequent than the eight hours relays of the colliers. But of course they need not ascend, they would only retreat towards the down-cast shaft.

I have no practical acquaintance with the subject, and therefore I speak with diffidence, but I have a sanguine hope, that in regard to the general run of the coal mines infested with gas, this system of ventilation would be so successful in ensuring purity of air in the workings, as not to require the current of major pressure to be so strong as that which is generally found to be necessary, which would be a great comfort to the men; and above all, that it would be found so efficient every way, as to banish that dangerous scientific toy, the Davy lamp, which has led to the loss of so many lives. It has been a lure, tempting men to the neglect of a proper ventilation of the pits, and ought never to have been introduced for working uses, but reserved for purposes of examination. Even if some improved lamps now made, secured absolute safety, and what is an equally important but perhaps hopeless matter, came into general use, still, for the sake of the health of the miners, measures ought to be taken to enable them to breathe a purer air.

As to blowers and goafs, your limits to the papers sent you, will not allow me to enter into an explanation of the mitigating effect which my system of ventilation would have upon them; neither, for the same reason, can I advert to the mechanical and other appliances which would be required to carry it into practice. I can only say that they need not be unreasonably expensive. The fan would perhaps answer the purpose very efficiently, its simplicity outweighing the objections to the needless velocity immediately given to the air, and also to this indirect method of increasing and diminishing pressure. I will only further observe, that if this system should be thought sufficiently reasonable to deserve a trial, it is by this publication of it open to any one to put it to that test.

BENJAMIN CHEVERTON.

◆

A NEW SYSTEM OF ARMOUR PLATING.

10 Wardrobe Place, Doctors' Commons, London,
7th March, 1862.

SIR,—In August last I sent you plans and description of a new mode of constructing iron ships for commercial and war purposes. My letter was inserted in your number of 13th September 1861, and subsequently I laid my plans before the special Committee on Iron, who decided that in their opinion, my system did not possess sufficient merit to warrant them in giving it a trial at the Government expense. I had proposed to do away entirely with the necessity for a backing of timber behind the armour-plates, and to do away also with all exterior fastenings. My mode of fastening was by means of flanges on the internal surface of the plates, which were attached to a wrought-iron frame of vertical and horizontal ribs, by means of bolts passing through the flanges and frame, and screwed up at the ends.

I was present on Tuesday at the experiment with Mr. W. Fairbairn's target at Shoeburyness; and the result has only confirmed the views which I have expressed in your paper with regard to any system which has yet been proposed for fastening on armour-plates from the outside. Mr. Fairbairn's target was a miserable failure, although all the resources of modern art had been employed in its construction. While on the ground I inspected the target now in course of construction from the design of Mr. J. S. Russell, and I venture to predict a worse failure in his case than in Mr. Fairbairn's, if subjected to the same test.

If the Iron plate Committee wish to test thoroughly whether the use of timber backing can be entirely avoided, they should give a trial to some plan in which the fastenings of the plates are all external. I am not so wedded to my own plan as to say it is the best of the kind which has been submitted to them: but I should like to see it, or some plan of internal fastening tried, for I look on the result of Tuesday's work as conclusive about outside fastenings on iron backing.

My object at present is to place before your readers a plan for a new system of armour-plating with the ordinary timber framing behind, which can either be applied to an iron ship such as the Warrior, or to one built entirely of wood. The plates can all be rolled in the same manner as railway bars, and the fastenings are all inside. As no planing would be required and the plates would only weigh from 170 to 190 lbs. per foot run, they might be manufactured to the large scale, ready fitted for the ship, at £10 to £15 per ton. I send you herewith two sketches, which will help to explain what I propose.

FIG. 1.

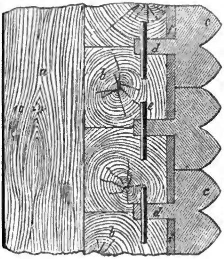
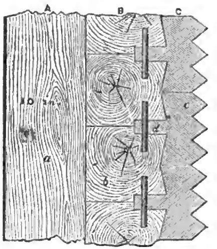


Fig. 1 represents a vertical section of a ship's side, *a*,*a*, are the interior vertical timbers 10 inches thick, *b*, *b*, are the exterior horizontal timbers 10 inches thick, *c*, *c*, are the armour plates, which may be rolled of any convenient length, say 15 or 20 feet. These have a base of 10 inches, and are let in between the horizontal timbers by a tongue *d*, 6 inches deep by 2 inches thick, which tongue is part of the plate, and extends all along the centre of the base line. The tongue is keyed to the timbers by iron keys *e*, each 7 × 2 × 1 inches, let into mortices. The armour plates have a thickness of 3 inches solid from the base line, and thence project 3 inches more in the cone-shaped form shown in the engraving, the object of this form being to break any missile which may be fired at them.

f, *f*, are iron plates, 10 inches wide by one inch thick, bolted on to the timber at the back of the plates and with a layer of bitumenized felt between them and the plates.

Fig. 2 represents a different and lighter kind of plating with angular grooves, and without the iron plates at the back, but the armour plates rolled and fastened in the same manner as in Fig. 1.

FIG. 2.



Should you deem the above worthy of a place in your Magazine, it will gratify me much, and may be the means of bringing my system to the test of experiment. I am, Sir,

Your obedient servant,

ROBERT BOWDEN.

◆

ON AN ATLANTIC CABLE.

SIR,—That England and America must not remain telegraphically disunited is the popular verdict. This is most gratifying, because it augurs the speedy accomplishment of an undertaking which every day proves to be an imperative necessity.

This matter of an Atlantic Telegraph Cable has, however, assumed a phase which is decidedly open to objection; and indeed, it ought never to have been assumed, especially when we take into connexion with it the circumstances attending the failure of the old cable.

There have been a multitude of fine spun theories on the subject of the failure of the old Atlantic Cable, most of them spun apparently for the express purpose of mystifying the whole matter, while really the truth floats on the surface, and "lies in a nutshell." The cable failed, for the very simple reason that the core was badly made, and of the wrong material; and secondly, because the construction of the outer sheathing rendered the whole cable, in consequence of its immense weight, totally unsuitable for deep seas.

For long distances of deep seas a cable is required of a light specific gravity, so that in paying out, the strain shall be sustained by the outer protection sheathing, instead of partly falling upon the core, which is unfitted to bear strain at all without damaging the insulation, and thereby risking the efficiency of the electrical capacities of the conductor. The spiral application of the iron wire sheathing, as in the Atlantic Cable, must ever be hazardous, from its tendency to elongate by its own enormous weight, and will thus expose the core to imminent destruction. And with respect to the core itself, it has only to be examined in certain parts to establish the fact of defective workmanship; while it is notorious that gutta-percha *is not the best insulator*, and, therefore, should never be used for the core of submarine cables —everything should be first-class, in consideration of the prodigious sum staked upon the venture.

Caoutchouc, or india-rubber, in its pure state, is a far more effective insulator, and no less superior in durability; the testimony afforded in proof of this by the Government Report is most ample and conclusive, and no less so with respect to the general construction of the cable as a whole.

One would scarcely go to sea in a leaky vessel; and if upwards of another half-million is to be invested in an Atlantic Cable, constructed of the same description of materials as the other, and upon the same principle; can the shareholders justly complain if their capital turn out to be but another supply of "costly food for fishes." Certainly, they will be entitled to no sympathy, while the consequences of another such a failure would be most disastrous, and probably retard the accomplishment of this great desideratum for another half century.

It is highly important, therefore, to guard against another such a casualty, and there is no better way to prevent its recurrence than the adoption of the improvements and discoveries which past failures have brought into existence.

There are cables manufactured which experiment has proved to be eminently adapted for deep seas; of less than a fourth of the weight of the old cable, and yet affording an equal amount of protection, strength, and durability; and so constructed as that no strain shall fall upon the core, while the insulation of copper wire with caoutchouc has attained that degree of proficiency as to constitute all that can be desired of the core.

If, however, all these improvements were eschewed, and the old style adhered to, certain failure is more then probable; hence if the cable is constructed in the same quarter as the other, people will be infatuated indeed if they do not make the guarantee of the effectual working of the cable for a term of years, a *sine qua non*. I am, yours, &c.,

PHILO.

A NEW FURNACE FOR BOILERS, &c.

March 10th, 1862.

SIR,—I desire to record a remarkable circumstance, attending the supplying furnaces with heated air which has been hitherto unnoticed, or at least, not made known,—it differs from the hot blast for smelting purposes—On April 12th last year, there appeared in the "Mechanics' Magazine" drawings and description of a new gas retort bed, a part of which showed a novel mode of feeding a furnace with heated air, obtained by keeping the ash-pit entirely closed, except when open for removing ashes, and an arrangement for passing one or more streams of air from the back of a gas retort bed through separate passages built in the solid brick-work immediately beneath the whole length of the lowest fire flues, from thence into the ash-pit and through the bars into the furnace, which can be likewise applied to a boiler bed. The result derived from this arrangement may surprise your readers, who would probably suppose this would occasion increased trouble with clinkers, the great object now being to prevent their forming, by having evaporating pans in the ash-pit, which mode also causes clinkers to form very hard, their removal often breaking the brickwork, whereas by thus totally reversing the usual mode and drawing out the heat absorbed by the brickwork, and that radiated from the floor of the furnace and repassing it through the bars, clinkers are formed of so soft a nature as to be removable with a rake. In fact, with one exception, firemen attending on these furnaces have told me they would sooner take care of two altered furnaces to one of the common construction, I believe when this becomes known and tried, it will be generally appreciated. Yours respectfully,

GEORGE WALCOTT, C.E.

THE PROPOSED OBELISK TO PRINCE ALBERT'S MEMORY.

SIR,—All those, and they are many, who perused with interest and pleasure the graphic accounts of the Nineveh marbles, with which Mr. Layard lately delighted and astonished the public, will recollect that one of the most curious facts connected with these marbles is that on some of them we find portrayed the very means adopted by those ancient engineers, the Egyptians and Assyrians, for transporting the enormous blocks of solid stone which were to decorate the palaces of their kings or the temples of their deities.

On the sand, they naturally found rollers of little use, and seem to have resorted to sledges sliding over it, assisted by grease; but on other more suitable ground, they did not ignore the use of rollers, though we have no evidence that they ever got so far as to make an artificial road or tramway.

Water, however, offers by far the best means of moving great weights, cheaply and well, and when it became necessary to remove these remains of ancient art to Europe, rafts were immediately resorted to by Mr. Layard; and wherever it was possible, no doubt such means were also used by the original constructors or architects. These rafts were either made of inflated skins, or in some cases, fragile as pottery proverbially is, of jars of no stouter material than baked clay, which in smooth water would answer tolerably well.

I am not about to advocate an exact imitation of this process, but only its general principle, as admirably adapted to the work now under consideration, of transporting to the metropolis a monolith which is to surpass all that the world has hitherto known, in its weight, dimensions, and grandeur.

Before the views of our beloved Queen on the subject were made public, many, no doubt, wished that some other less well-known form than the obelisk —for the expression of a feeling in which all without distinction concurred—might be tastefully found, and wisely carried out. But from the moment when Her Majesty's decision was heard, no thought remained but of how best to give it effect.

Thus we have seen but a few days afterwards the decision of the commissioners for the purpose on the material, namely that the red granite of Scotland should be employed, and the problem now seems only to be, how best to transport the huge monolith from its primeval bed near the ocean shore to the site which the Ocean Queen has chosen for the commemorative monument to her best and dearest.

Some years ago, an experiment, which hitherto seems to have borne but little fruit, demonstrated in one of our great harbours the fact that large guns or anchors might be floated, and so conveyed by water, by merely buoying them, so to speak, with canvass bags. If I recollect right, the width of the bags in the case of the anchor was no greater than its flukes. The bags were inflated with air, and laced to the anchor or gun, and answered perfectly well so long as they were kept wet, which, of course, was always the case. By a modification of such means, there would be no difficulty, nor any great expense, in making a sort of air bed, divided into as many cells as may be deemed advisable, on which a monolith of any size might be floated in perfect safety, and be towed from Aberdeen, or elsewhere, up the Thames, under all the bridges, till, on arriving at Hammersmith Bridge, it might leave the river by an inclined plane, and be forwarded to its ultimate destination along a tramway to be laid in Hammersmith and Kensington Roads.

Some may object to the use of canvas for such a purpose; but my own opinion is, that it would be less subject to damage in water than a cellular metallic structure embracing the stone, which seems to be the only other feasible plan.

I append some information on the comparative sizes of obelisks, from sources which may not be otherwise easily accessible to some of your readers, and cannot fail to be interesting. Two obelisks erected by Sesostris in Heliopolis, 180 feet high. Obelisk mentioned by Diodorus Siculus; 130 feet high, 25 feet square at base. Lateran; 105 feet, 440 tons weight. Obelisk at St. Peters's; 132 feet, including pedestal. Obelisk of Luxor, Paris, 76 feet. Cleopatra's Needle, 63 feet. J. H. SELWYN, Capt. R.N.

THE VELOCITIES OF LIGHT IN DIFFERENT MEDIA.

SIR,—In reply to Professor Rankine, I observe, first, that all mathematical investigations of the kind in question are to me unintelligible, and this, because they are founded upon data which really have no reference to the result denied. As an example, the argument of Sir John Herschel may be named, as regards which, and his conclusion, I will undertake to affirm, that nine-tenths of the readers of the MECHANICS' MAGAZINE, who are aware of the enormous error of mathematical reasoning, without a *sufficiency* of practical data will both agree with my conclusion, and see the fairness of the way in which I have come by it.

And secondly, concerning the experiment of Foucault, with which I was acquainted, I allow that, with respect to its principles, it is a philosophical one; but, seeing that the image of the wire is reflected from the glass through which it has passed, and is therefore a dull one, I submit that, the distances being very minute, the experiment cannot be set down as altogether trustworthy. On the contrary, the method of M. Fizeau, a short description of which may be found in "Hunt's Elementary Physics," p. 302, is a satisfactory one. It would, however, be improved, if the disc were of glass, and very accurately graduated at its circumference. I have (MECHANICS' MAGAZINE, Nos. 88 and 85, new series) shown how the velocity which light loses both by reflection and refraction, can be ascertained, and have not till now been aware, that my method, and that of M. Foucault, are nearly the same. Your readers can ascertain the differences, and I shall here only add, that I think the condition of various reflections, and the proposal to conduct the light to a sensitive plate, cannot be set down as improvements. The various reflections allow the experiment to be compactly formed, and the sensitive place the result, which would be in the condition of quiescence, to be inspected as often as desired, which would be a great advantage.

I am, sir, yours, &c.,

J. ALEXANDER DAVIES.

March 4th, 1861.

MINERS' HAVENS OF REFUGE.

SIR,—I have but just seen a letter upon the above subject, which appeared in the MECHANIC'S MAGAZINE for February the 14th (I receive my magazine in monthly parts). I am glad to find that Mr. Walcott has written upon so important a question, and that you, Sir, have given his views admission into your valuable magazine. Upon the occurrence of that fearful catastrophe at Hartley, I addressed a letter to the *Times* (which as a matter of course was taken no notice of), suggesting the construction of havens of refuge, &c., in mines. I proposed that while such havens should be proof against the entrance of the deadly gases which are generated in mines in the north of England, fresh air should be supplied by air pumps from above the surface, or by pipes in connexion with the havens. That each haven should be supplied with a quantity of preserved food, which might be rendered available in the event of egress from, or ingress to the mine, being for any length of time, made impossible, either from a like accident to that which happened at Hartley; or from the circumstance of foul air causing the exit from the mine to be hazardous or impracticable. I proposed, moreover, that helmets, &c., such as are used by divers, should be provided, in order to enable the occupants of the havens to make excursions in the neighbourhood, in search of those, who being overcome by the effect of foul air, might be unable to reach those places of safety proposed. That means should be supplied with contrivances similar in their mode of operation to diving bells, for the purpose of enabling those from above to make explorations of such portions of mines as are near the base of the shaft, at a time when exploration otherwise conducted might, on account of falling masses, or the presence of noxious gases, expose the explorers to imminent peril. I also suggested that every mine should be supplied with one or two telegraphic wires (or perhaps a tube in connexion with the haven, through which the sound of the human voice might pass, would be more simple and effective), so that the workers might have it in their power to communicate with those above. This latter suggestion, whatever may be thought of those going before, might, I feel persuaded, very easily be carried out, and would in the hour of trouble and danger, be the means of affording immense consolation, and of conveying useful and sound advice to and from the miners, either upon the occasion of an explosion of fire-damp, or upon the occurrence of a like catastrophe to that we have so recently had to deplore. What comfort those poor incarcerated and stifled men might have derived throughout their imprisonment, from intercourse with those they loved! How many might have had a last parting word to have spoken, or instruction to have given to their friends and relations! What relief, too, would it have been to their sorrowing relatives to have been aware—which they would have been so soon—as all messages ceased to pass from below, of the exact time when suffering was over! But apart from these considerations, I believe a system of telegraphy might, for various reasons, be of infinite use in mines.

I am, sir, your obedient servant,

C. PEMBERTON CARTER.

Kennington-hall, near Ashford, Kent, March 11th, 1862.

THE STEERING OF SHIPS.

The Hague, 5th March, 1862.

SIR,—The article on the "*steering of ships of war*," contained in the MECHANICS' MAGAZINE of the 28th of last month induces me to send you a copy of a letter which I wrote to Admiral Sir George Sartorius on the subject. It was as follows:—

"The Hague, 24th December, 1861.

"SIR,—I have read with great interest your *Essay* named 'Our Iron Fleet,' contained in the *United Service Magazine* for November last, allow me to make a few observations on a part of the subject—

"The ships of the 'Warrior tribe' will certainly be difficult to manage. Why! Because they are extremely long, and in them as in all other ships, rotation depends mainly on progression, or, in other words, because they cannot turn round unless they are in motion, and do that the worse, the slower their progression is.

"In my opinion, such large and costly vessels of war ought to be able to rotate on their vertical axis, independently of progression, and without any progression whatsoever. They could then always turn so as to receive an enemy's fire under an angle, say of 45 deg., and would in many, if not in most cases, be able to avoid the ram attack, or render it unavailing by rotation.

"The most elementary notions of mechanics must, I think, lead to the conclusion that rudder-steering is, for all war purposes, a most rude and imperfect process, and never can answer for the adequate management of long iron-cased frigates such as the Warrior, or even the Gloire. Of course, there can be no question of abolishing the rudder, *at least for the present;* but it seems absolutely necessary to combine with or add to it an active power of rotation totally independent of propulsion, though possibly derived from one source.

"The enormous force of the steam-engines should be used to produce rotation as well as progression. The object might be attained in many ways; for instance, by jets of steam or of water, or of *compressed air*, working at right angles to the principal plane of the ship, at the greatest possible distance from her axis of rotation. Of such jets there should be, *at least*, four, two fore and two aft, to work as *couples*, left fore and right aft, or right fore and left aft, as might be required. I believe that there cannot be any serious objection to the apertures that would be required for such jets. For it would be easy to construct the apparatus so that there could not be any danger of leaking from it.

"Of the means mentioned, perhaps compressed air would be the most suitable, because it could be stored up for use to an amount sufficient for any emergency, and loss of air from use could most easily be repaired by the power of the steam-engine working on air pumps.

"That is, in my opinion, the outline of what is to come for war ships with regard to steering. Means must be supplied, sufficient to produce, at any time, rapid rotation independently of progression. The rudder might be used in ordinary cases. The jets would come into play in action, and if the rudder were disabled or insufficient.

"I take a great interest in the progress of your iron navy, and it seems to me when I consider what efforts are being made to secure invulnerability by thickness of plating, and also by application of the angular principle, *that the question of independent rotation* is a vital one."

My letter being anonymous, the gallant Admiral could not take any notice of it. Possibly he disapproves of the general means implied in it. For my part, I still believe that compressed air that might be produced to any required amount of force, by the available steam power of the ship, and be stored up to be applied at pleasure, in some such way as that outlined in my letter, would be a most efficacious means of *independent rotation*, which seems to me the *sine qua non* of long war ships.

I am sir, your most obedient servant,

A Military Engineer.

Gossip.

In his "Manners and Customs of the Ancient Egyptians," Wilkinson clearly demonstrates the fact that the workmen of Egypt, in the days of the Pharaohs, were excellent handicraftsmen, and that they never "scamped" their work. Indeed some lessons are even yet to be learnt from them. In carpentry the Egyptians of old greatly excelled, their mode of joining boards together is worthy of remark, combining as it did strength and neatness. When two boards are joined together on edge by our modern carpenters they frequently insert small round pins into corresponding parts of the edges, and then apply them together. The Egyptian carpenter was not content with this precaution, and having used flat pins for the purpose, about two inches in breadth, he secured these again after the boards had been applied to each other by round pins driven vertically through the boards, and into each of the flat pins. Thus the possibility of the joint opening was effectually prevented. The saw, the chisel, the hatchet, the adze, and the drill were well known to the Egyptians of the time of Moses, as were the processes of veneering and dovetailing. There is no doubt either that 3,300 years ago the glue pot was in requisition in the workshops of Memphis and Thebes.

Now that history is being laid under tribute in the search for precedents in reference to the quarrying and erection of obelisks, and monoliths of other forms and shapes, it may not be improper to borrow from Herodotus the account which he gives of the transportation during the reign, and by order of, Amasis, a king of ancient Egypt, of a granite monolith of gigantic size. Let Herodotus speak for himself however:—"What in my opinion deserves the greatest admiration, is an edifice of a single stone, brought from the city of Elephantine, a distance of about twenty day's journey. Two thousand men chosen from the class of boatmen were employed for the space of three years in transporting it to Saïs. Its external length is twenty-one cubits, its breadth fourteen, and its height eight; and in the inside it measures eighteen cubits and twenty digits in length, twelve in breadth, and five in height. It stands near the entrance of the temple; and the reason of its being left in this spot was, that the architect, wearied with the tedious duration of the undertaking, was heard to fetch a deep sigh, while they were employed in dragging it forward. Amasis, who happened to be present, at once gave orders they should stop and carry it no further. Some, however, assert that one of the men while moving it with a lever, was crushed to death, and that on this account they were ordered to desist." Amasis, the monarch referred to by Herodotus, it may be said *en passant*, commenced to reign 571 B.C., and died 525 B. C. Many other dealings with stone are attributed to him.

In our report last week of the trial of the Iron Plate Committee's target, at Shoeburyness, a description of the concluding part of the experiments was accidentally omitted. We supply the omission, as it refers to a particular class of missile the affect of which requires to be understood. After the artillery practice described in our report, a fourth round was fired against the middle left hand plate of which nearly all the bolts were broken by two previous rounds. It consisted of three 200lbs. Armstrong bolts discharged singly from 100-pounder Armstrong guns with a charge of 10lbs. of gunpowder, which is less than the ordinary charge for 100lb. bolts. The reason assigned for this reduction is the resistance of a 200lb. shot, which is so much greater than a 100-pounder is calculated to bear that the guns would be liable to burst if loaded with a full charge. The want of sufficient propelling force and the great weight of the projectile reduced the velocity so considerably that these ponderous masses produced no penetrating effect on the iron beyond a slight indendation, but their great weight hurled at a plate already damaged and almost denuded of its fastenings drove in the centre and curled up the butts more than six inches from the frame. The few remaining bolts were broken off at the nuts. This destructive result no doubt is to be ascribed to vibration, because although the impact of successive discharges was received by the middle plate above the bolts of the top and bottom plates of which the fastenings were unconnected with the middle plate, were broken by the same discharges in consequence of the shock being communicated to the frame to which the nuts were screwed up.

Dr. Perron, of Besancon, where there are more than 3,000 persons engaged in the manufacture of watches, in his paper adverts to the mischief which accrues from the constant manipulation of copper. His conclusions are as follows:—1. The molecular absorption of the salts and oxides of copper give rise to gastric irritation, diarrhœa, fever, &c.—in fact, to the symptoms of poisoning all but in degree. 2. Successive slow poisonings of this kind derange the health of the workman, and powerfully predisposes him to phthisis (a disease of frequent occurrence among the Besancon watchmakers). 3. They require him to take corporeal exercise, carried even to fatigue, and justify the frequent employment of evacuants and sudorifics. 4. Manipulations of copper or other metals should be interdicted to thin and excitable persons of a dry, bilious temperament, and who have any congenital or acquired disposition to phthisis. 5. This affection is best prevented by the use of succulent aliments, and tonic drinks, the thorough ventilation of the workshops, great cleanliness, frequent tepid bath, and wearing the moustache.

The *Revue Contemporaine* publishes an article, by Comte de Latour, on the important question of the part which cavalry is likely to play in future wars. The count, among other things, says that the opinions now generally held regarding the power of the new fire-arms are vastly exaggerated, and shows that many more men were lost in the great battles of the empire than in the last Italian campaign. At Austerlitz, the Russians lost 30 per cent., the Austrians, 44 per cent. of their army; the French lost 14 per cent. At Wagram the loss of the Austrians was 14, that of the French 13 per cent. At La Moskowa, the Russians lost 44 per cent.; at Waterloo, the allies lost 31 per cent., the French 36 per cent. At Magenta, on the contrary, the Austrian loss was not more than 8 per cent., that of the French only 7; at Solferino, the Austrians sustained a similar loss, and the Franco-Sardinians only lost one-tenth. This may be explained by the fact that a long range obliges the projectile to describe a large curve; thus, according to M' d'Azémar, if the column of the Place Vendome were placed between the gun and the mark, the latter being at a distance of 2,500 yards, the projectile would pass clean over the monument without touching it.

A few days since an interesting passage of words took place between the Pera telegraph office and the Central Office, Lothbury, London. The whole line through between the two capitals being open, Mr. O'Connor, the director of our local office, flashed his salutations through to his compeer at the other end, and received back acknowledgment in one minute. The following conversation then ensued:—"What sort of weather have you on the Bosphorus?" "Fine, with thermometer marking 7 deg." "Is Odessa still closed with ice?" "Yes, two days ago navigation was again interrupted." "What kind of weather have you in London?" "Magnificent." "What o'clock is it with you in Constantinople?" "Four o'clock." "What with you in London?" "Ten minutes past two." "Pray, what is your name?" "Carron; yours?" "O'Connor." "Are you an Englishman?" "Yes." "A warm shake of the hand to you." "Thanks, the same to you." "Have you any messages for London?" "Yes, a few." "Pray send them on."

Mr. Cunningham, M.P., in a letter to the *Morning Star*, on the proposed obelisk, as a memorial to Prince Albert, says:—"If we are now to be condemned to successive experimental 'revivals' in art, at all events let them be intelligible and complete—not spurious imitations and at second-hand—disfigured by incongruous modern accessories, by which the simplicity or character of the originals is entirely destroyed. In the decline of Roman civilisation, when invention in ancient art had reached its lowest depth, then it became the fashion to import single 'obelisks' from abroad, regardless of the fact that these huge monoliths, in their original sites, were always erected in pairs, at the entrance of temples dedicated to divinities. But when transplanted to their new abodes, these characteristic monuments of a bygone civilization degenerated into mere symbols of conquest, and, at the same time, became indestructible memorials of the decline of the arts under a military dess potism, which heralded the fall of the empire. To u let this act as a warning, not as an example to be followed and perpetuated."

Last week, at the chain cable and anchor works belonging to Messrs. Brown, Lennox, and Co., Millwall, Poplar, experiments were tried for the purpose of testing Bradbrook's smoke and noxious vapour respirators. The whole of the persons present took part in the experiments. In an iron fire-proof oven, about the size of an ordinary room, a large charcoal fire was made, which was fed for some time with paraffine oil, turpentine, assafœtida, gas tar, and wet straw, when a dense and suffocating smoke was produced. Mr. Gordon, Mr. Roberts, his sons, and the whole of the escape-men, with the respirator on their mouths, entered the oven. They remained in it for a period of 13½ minutes. In addition to the above ingredients a large quantity of sublimate of copper, a deadly poison, was also put upon the furnaces, and yet all the persons in the oven were enabled to breathe without the least difficulty. The only inconvenience they experienced arose from the excessiva heat. The Royal Society for the Protection of Life from Fire were so satisfied with the experiments that they have ordered a number of the respirators for the use of the conductors. The apparatus is exceedingly light, and any one wearing it can speak freely without the least danger of inhaling either heated smoke or noxious vapour.

The *Athenæum* says the proposed tunnel through Mont Cenis, which has already been made to the extent of 5,010 feet, is now likely to be completed, as the serious rock difficulties are in a fair way of being overcome by a mechanical contrivance at once singular and beautiful. Messrs. Hawks, Crawshay, and Co., have constructed a machine similar in appearance to a small locomotive engine, without a vertical funnel, however, which is contrived to turn a large wheel in the front with enormous power. This wheel carries a series of cutting knives, formed of teeth of the best steel, which are intended to bore auger-fashion into the rock, while rakes attached to the machine will remove the fragments of rock detached by the knives. The engine will be propelled forward by its own steam-power, the smoke from the furnace escaping by a horizontal funnel. It is worthy of note that Messrs. Hawks, Crawshay, and Co. contrived this machine for underminig Sebastopol; its new purpose is a happy illustration of turning the sword into a reaping-hook.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2056, 2062, 2068.
Boilers and their Furnaces, &c., 2108.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2063, 2069.
Ships and Boats, including their fittings, 2076, 2092, 2095.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2060, 2078, 2081, 2097, 2106.
Food and Beverages, including apparatus for preparing food for men and animals, 2067, 2074, 2085.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2072, 2090, 2094, 2096, 2103.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2054, 2084, 2102.
Lighting, Heating, and Ventilating, 2053, 2055, 2057, 2058, 2071, 2075, 2083, 2087.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2064, 2066, 2070, 2086, 2091, 2099, 2100.
Metals, including apparatus for their manufacture, 2077.
Chemistry and Photography, 2073.
Electrical Apparatus, *None.*
Warfare, 2093, 2104.
Letter-Press Printing, &c., 2088.
Miscellaneous, 2059, 2061, 2065, 2079, 2080, 2082, 2089, 2098, 2101, 2105, 2107.

2053. W. Bennett. *A new composition for the lighting of fires.* Dated August 19, 1861.

The patentee claims the manufacture of fire lights and fuel by the immersion or dipping of dried peat into melted resin. *Patent completed.*

2054. Z. Colburn. *Improvements in the construction of suspension bridges.* Dated August 19, 1861.

This consists in the substitution in place [illegible] flexible iron or other chains, or the flexib suspension bridges, of continuous and rigid wrought-iron or steel suspending bars, flanged or otherwise stiffened, the axis of each of which is curved as nearly as may be to the catenary curve, corresponding to a wire of uniform diameter and weight, and suspended from two points, so as to have the same span and versed sine. From these rigid curved bars the roadway, which may or may not have stiffening trussing in addition, is suspended in the usual manner by vertical or diagonal suspending rods or wires. *Patent abandoned.*

2055. J. Roan. *Improvements in ventilating.* Dated August 19, 1861.

The principle adopted by this invention is that of admitting the necessary supply of fresh air at a low level, and carrying off the vitiated air at a higher level. In ordinary cases, the method used is to provide an opening at the bottom of the windows for the ingress of the fresh air, and a similar opening at the top or upper part of the windows for the escape of the heated and vitiated air, such openings being covered with perforated card, paper, gauze, &c. *Patent abandoned.*

2056. G. T. Seely. *An improvement in surface condensers.* Dated August 19, 1861.

This invention consists in making the tubes of condensers of a spiral or worm form for the whole or part of their length, instead of straight, as heretofore. The spiral or worm form will admit of expansion and contraction in the length of the tube, without affecting the joints, where the ends of the tubes are fixed tight and fast in the plates or sides of the cistern of the condenser. *Patent completed.*

2057. E. S. Cathels. *Improvements in compensating gas meters.* Dated August 19, 1861.

This invention consists in a mode of maintaining a constantly uniform water line or level in gas meters, by compensating for the loss of water in the meter by evaporation or otherwise. *Patent completed.*

2058. W. H. Smith. *Improvements in the preparation, application, and manufacture of peat.* Dated August 19, 861.

The patentee claims, 1. The vulcanization of raw peat, or its reduction to a homogeneous pulpy mass, by heat as a solvent, the said heat being engendered by the direct application of steam or ordinary fuel, or induced chemically by friction accompanied by trituration, as described. 2. The vulcanization of mixed peat, or peat in combination or admixture with various acids, alkalies, ores, earths, and so forth, for the purpose of altering the colour and texture of the said peat, rendering it more or less hard, dense, compact, plastic, combustible, and so forth, either by heat alone, or heat induced by and accompanied with mechanical trituration. 3. The application of vulcanized peat to various useful and ornamental purposes. 4. The application to vulcanized peat of the process of trituration through perforated metallic plates, the said process, although in common use for many years having never been applied to peat prepared in accordance with the within specified process of vulcanization. *Patent completed.*

2059. W. Gossage. *Improvements in the manufacture of certain kinds of soap, and in the construction of apparatus to be used in such manufacture.* Dated August 19, 1861.

The patentee claims, 1, the use of steam generated by the concentration of caustic alkaline liquors or soap lyes in close boilers, for the manufacture of those kinds of soap in which the boiling is effected by the employment of steam. 2. The construction of apparatus to be used in the manufacture of those kinds of soap which are made by injection of steam amongst the materials employed, which apparatus provides for the steam employed being passed through a bed of filtering materials, and thereby causing the separation of particles of water therefrom, previously to its being used for such manufacture. *Patent completed.*

2060. W. Firth. *Improvements in machinery for digging or turning up soil, mowing, reaping, and other agricultural purposes.* Dated August 19, 1861.

This consists in an arrangement of a series of picks for digging, or knives or cutters for mowing or reaping, worked by springs. The springs are regulated by wheels or cylinders and tappets, or other suitable mechanical contrivances, so that, being coiled or drawn up by the wheels or cylinders, they are liberated by the tappets, so as to act upon the digger and thus produce one stroke of it, or more than one stroke at each action of the spring knife, or cutter, which is repeated in the same manner so as to produce a successive series of strokes. *Patent abandoned.*

2061. T. Pruaick. *Improvements in obtaining and applying motive power.* Dated August 19, 1861.

Here the patentee uses the force of water set in motion by pistons or plungers (which pistons and plungers may be put and kept in work, by hand, by steam power, or the full force of water), which he purposes to effect by the use of an axle or shaft (or of axles to shafts), whereby the pistons or plungers connected therewith, and working in water cylinders or pumps of equal size, are duly acted upon, the said cylinders being each of them connected to other cylinders by a tube or pipe of considerably less bore than the respective areas of the cylinders. Of course, instead of four cylinders there may be a greater number, eight or twelve for instance, if thought expedient. The cylinders are to have the necessary appliances for rendering the pumping action or motions of the pistons or plungers effective, and communicating the power obtained to the purposes required. *Patent completed.*

2062. B. Hargreaves and J. Hargreaves. *Improvements in the valves of steam engines.* Dated August 20, 861.

Here instead of feeding the steam from the end of the valve flange, the inventors make a transverse slot in it, through which the steam passes and feeds the piston; the passage or thoroughfare being made larger in proportion, in order to admit of a large exhaust. They also make an alteration in the eccentric, by working the connection on two circles, to reverse the speed of the valve at the change of the piston. *Patent abandoned.*

2063. G. Ingram. *An improved endless train to be used in connection with the wheels of carriages on common roads.* Dated August 20, 1861.

This consists in forming an endless train through the medium of jointed link couplings, channelled throughout on the inner surface, in which the wheels take, and are caused to run, bearing guide rollers being employed for directing and giving increased freedom to the action of the tram, and the said tram being applicable to a line or train of carriages by causing the first pair of wheels to be provided with a train arranged as above described, whilst the remainder thereof are to be furnished with a train passing round the peripheries, so as to form one continuous channel way round the same. *Patent completed.*

2064. A. S. Rostaing. *Improvements in constructing spectacles, consisting in a new mechanism which the inventor calls arch spring lever.* Dated August 20, 1861.

Here the patentee claims an arched spring lever or hinged bridge piece (when applied to spectacles of any shape or form) having for its purpose the raising of spectacles from before the eyes up to and before, but not on to, the forehead or hair. *Patent completed.*

2065. W. Pitkin. *Improvements in apparatus or instruments for extracting teeth.* Dated August 20, 1861.

This consists of two separate portions, instruments, or appliances, which, when put to use, are employed in conjunction or combination. Each part has a handle or end conveniently formed for holding and using it, and one of these instruments or appliances, which the patentee calls the "fulcrum instrument," is constructed with a part or surface called the "rest piece" (intended to bear or rest against the gum or jaw of the patient), and also with a curved or bent arm, or what he calls a "bridge piece" or arch, which is so shaped that, when the rest piece is applied against the gum, this bridge piece or arch passes over the tooth, and affords a fulcrum or bearing point for the second instrument or elevator to rest and work upon at the opposite side of the gum to that against which the rest piece is applied. *Patent completed.*

2066. H. Emes. *Improvements in dress fastenings, which are also applicable to other purposes.* Dated Aug 20, 1861.

This invention is not described apart from the drawings. *Patent abandoned*

2067. R. A. Brooman. *An improvement in preserving meat and other animal substances.* (A communication.) Dated August 20, 1861.

This invention consists in preserving meat and other animal substances by means of gluten, and principally of gluten prepared as described in the specification of Letters Patent granted of the present patentee 18th July 1860, No. 1742 and which he calls "Lucine." *Patent completed.*

2068. R. A. Brooman. *An improved steam mill or apparatus for transmitting motive power.* (A communication.) Dated August 20, 1861.

This invention consists in transmitting motion to a shaft or shafts by preference in a vertical position from a locomotive engine free to travel round a circular platform. The shaft is connected to the locomotive by a lever, and carries a drum, or drum pulley or pulleys round which the driving straps pass. In some cases gearing is used for transmitting the power. The central shaft carrying the drums may be above or below the level at which the locomotive travels. *Patent abandoned.*

2069. S. Whittaker and R. A. Jones. *Improvements in operating upon railway signals, and in indicating their position by means of electricity.* Dated August 20, 1861.

This invention consists, primarily in certain means for indicating the position of an auxiliary signal to the attendant working the same when the signal is not within view, and is intended to remedy the evils arising from the constant slacking of the wire for working the signals. *Patent completed.*

2070. S. Warwick. *An improvement or improvements applicable to concertinas.* Dated August 20, 1861.

The object of these improvements is to afford double action to each of the reeds used in a concertina, and the inventor produces the same note from the same reed in both cases, by the press and draw movements of the instrument. *Patent abandoned.*

2071. J. Somerville. *Improvements in apparatus for drilling and tapping gas and water mains and pipes, and preventing leakage therefrom.* Dated August 20, 1861.

According to this invention the patentee proposes to employ a peculiar apparatus, consisting of a bow or bridge piece or bracket, secured to the main or pipe to be drilled by clips or straps, and having fitted to it at its centre, or in any other convenient position, a set screw, for the purpose of applying pressure to a combined drill and tap of a peculiar construction, which is actuated by an ordinary ratchet or other suitable contrivance. *Patent completed.*

2072. J. Platts. *Improvements in looms for weaving.* Dated August 20, 1861.

This relates to the arrangement and construction of power looms, which are more particularly adapted for weaving the class of fabrics known as Scotch carpeting. Under one modification or arrangement of the mechanical parts the loom is fitted with an ordinary jacquard apparatus for producing the predetermined figure on the fabric to be woven. The motion of the jacquard barrel is derived from the crank-shaft of the loom, by a disc wheel, cam, or other equivalent therefor, or by levers from the bottom shafts, so as to render the motion of the jacquard barrel automatic, and bring the cards round in regular succession. The required segmental movement of the shuttle boxes, by which the different colored wefts are thrown across the shed in the required succession, is obtained from the crank shaft. *Patent completed.*

2073. T. Sutton. *An improved camera, for taking photographic portraits and instantaneous pictures* Dated August 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2074. R. S. Lambert. *An improved skipping dipper or vessel for removing sugar and other liquids from boiling pans.* Dated August 20, 1861.

The nature of this invention consists in the construction of a dipper, provided, 1st, with external ribs or yards, so applied as to prevent the contact of the exterior surfaces of the vessel with the interior surfaces of the pans from which it is intended to dip up the contents, whereby the heated surfaces of these latter, even whilst the improved dipper is actually within them charged with a portion of their contents ready for removal, remain covered with liquid matter in quantity always sufficient to prevent injury from charring or scorching. 2, of a cover (by preference a dome or elevated cover) which enables the operator to change over or take into the pans in action, and before the improved dipper is in any degree lifted out or removed therefrom, sufficient liquid to replace that taken into the improved dipper for removal, so that when this vessel and its charge are actually lifted away, the pan is found to be already replenished. By these means all possibility of injury from the destructive effects of large over-heated surfaces acting on small quantities of highly [illegible] substances is wholly avoided. *Patent completed.*

2075. F. Gye. *Improvements in constructing gasometers and gasometer tanks.* Dated August 20, 1861.

Here the patentee makes the tank for a gasometer double at the outer circumference to receive the water or fluid employed, the interior space being left free for use when roofed or closed in air-tight or gas-tight. He prefers to use the compartment in the centre of a tank to act as a second or interior tank to receive another but a smaller gasometer. *Patent completed.*

2076. G. F. Muntz. *Improvements in sheathing iron ships and vessels.* Dated Aug. 20, 1861.

This consists in sheathing iron ships with copper or muntz's metal, or other suitable compound metal, so as to insulate such copper or metal electrically by using fastenings made of nonconducting material, for which purpose the patentee prefers nails or plugs made of a compound of india-rubber, known as vulcanite or ebonite, and he places between the metallic sheaths and the iron ship sheets of india-rubber or other sheets of iron nonconducting material; these may either be attached to the metallic sheets by Daft's patent process or held in place by merely driving through them the nails or plugs which are used to attach the metallic sheaths to the ships. *Patent completed.*

2077. G. F. Muntz. *Improvements in apparatus for melting metals.* Dated August 20, 1861.

Here the inventor places the metal in a vessel of brickwork lined with fire-clay, and through the bottom of the vessel holes are formed which are covered with tubes, similar to inverted crucibles without bottoms, and made in a similar manner of fire clay. Under the vessel a furnace is formed, and the heat passes up into and is transmitted through the refractory tubes to the metal. *Patent abandoned.*

2078. N. Fisher. *Improvements in agricultural implements for grubbing and cultivating land.* Dated August 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2079. J. Ellis. *Mechanism for sizing corks or separating the larger from the smaller sized corks.* Dated August 20, 1861.

The patentee claims the use of mechanism for gauging or separating the larger from the smaller sized corks, consisting of a worm or propelling shaft, acting in conjunction with an open work or gauging cylinder or cylinders, so as to gauge or separate the larger from the smaller sized corks as required. *Patent completed.*

2080. C. A. Wheeler. *Improvements in preventing wind draughts at the foot of doors, and allowing them to open over carpets or other substances without the use of rising hinges.* Dated August 21, 1861.

This consists of two pieces of moulding the width of the door, the lower piece being much stouter and heavier than the other piece; they are attached to each other by cords or chains, leaving a space between the two to allow the lower moulding to arise and pass over the carpet. The upper moulding is made fast to the face of the door, suspending the lower moulding ½ of an inch or more from the floor; and in front of these mouldings, between them and the door, is a piece of air-tight cloth the width of the door, which is attached to the upper piece of moulding, or to the face of the door, and which rests upon the floor. The lower piece of moulding rises and falls with the opening or closing of the door, and presses against the air-tight cloth, thereby preventing any wind or draught from entering the room. *Patent abandoned.*

2081. T. Lambert. *An improved agricultural implement for rolling ridges and furrows or straight work.* Dated August 21, 1861.

This consists in mounting two or more metal rollers loosely side by side upon a rod, and at suitable distances asunder, the said rod and rollers being held in a framing to which shafts or other appliances are connected for enabling the rollers to be drawn by horses. The rollers employed for rolling ridges and furrows are suitably formed for that purpose, whilst the other or intermediate rollers which keep the aforesaid ridge and furrow rollers at the proper distances asunder are formed cylindrical, and of considerably smaller diameter, so that for straight work, by removing the ridge and furrow rollers, and connecting the cylindrical rollers together, a plain roller may thus be produced adopted for straight work. *Patent abandoned.*

2082. W. Mason. *An improved soap.* (A communication.) Dated August 21, 1861.

The object of this invention is to dispense with hand washing in the cleansing of clothes and other articles. The improved soap consists of equal parts of any ordinary soap and kaolin, with about five per cent. of ammonia and five per cent. of soda; the whole is mixed together and dried. *Patent abandoned.*

2083. W. Clark. *Improvements in optical and illuminating apparatus.* (A communication.) Dated Aug. 21, 1861.

This invention consists in the application of all transparent matters, either coloured or uncoloured and polished or unpolished, having hollow spaces or compartments filled with liquids, instead of the ordinary solid glass hitherto employed for general illuminating purposes, as also for the production of effects of white or coloured fire at public entertainments. *Patent completed.*

2084. W. Clark. *Improvements in the construction of buildings, whereby to utilise the waste heat passing up the chimnies.* (A communication.) Dated Aug. 21, 1861.

This relates to an arrangement of the flues of the several fire places of a house, which are all made to unite in a chamber placed under the roof, and furnished with an opening for the escape of the smoke. This chamber is made of bricks or stones for the sides, and iron for the bottom; a door is placed for affording access to this chamber, which is also of iron; the aperture for the escape of smoke may be furnished with a smoke distributor. Water cisterns may be placed in the chamber with a float open to the exterior, serving for various domestic purposes. *Patent abandoned.*

2085. A. Stein. *Improvements in distillation.* Dated August 21, 1861.

The object here is first to improve the quality of the spirits, whether grain or malt, produced from the class of stills now in use under the patents of R. Stein (No. 5721), dated December 4, 1828, and A. Coffey (No. 5974), dated August 5, 1833. Secondly, to render the "spent wash" or dreg which is discharged from these stills after the spirit has been extracted from it, more valuable for the feeding of live stock, to which purpose it is now principally applied. It is proposed, by suitable modifications and additions, to pass the whole, or such portion of the alcoholic matter as may be found desirable, into the rectifier in a liquid state; it is then to be worked off by fresh steam, and no part returned to mix with the wash in the distilling column, reserving to the distiller power to withhold any portion of the alcoholic vapour from passing into the rectifier, and passing it direct from the purifier into a spirit worm to be condensed and cooled. *Patent abandoned.*

2086. N. Salamon. *Attachments or apparatus for sewing machines.* (A communication.) Dated August 21, 1861.

This consists 1. In a contrivance which can be readily adapted and attached to any suitable sewing machine. By means of this contrivance two pieces of cloth (suitable for ruffling) are caused to be supplied to the ordinary feeding along apparatus of the sewing machine at different tensions while being sewn together. 2. In a contrivance for automatically creasing or making, in regulated uniform distances in advance of the sewing, the next line of sewing to be followed, which is essentially useful in folding and tucking by machine sewing, as by it the folds and tucks or plaits can be sewn at exact distances, in precisely the same repetition, without requiring previous preparation by hand. Lastly in a modification of the last-named contrivance, according to which the attachment is arranged so as to be applied to quilting, &c., by marking with a piece of chalk or other substance upon the material being sewn so as to indicate precisely the next line of sewing to be followed. *Patent completed.*

2087. A. A. Hennart. *A new system of constructing economical smoke-consuming grates.* Dated Aug. 21, 1861.

This consists in the combined form or shape and arrangement of the grate bars of furnaces. These bars are composed of three pieces cast together so as to form a single one, leaving many open spaces between each compound bar to give free passage to the atmospheric air. *Patent abandoned.*

2088. M. A. P. Mennons. *Certain improvements in presses for lithographic printing.* (A communication.) Dated August 21, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2089. J. M. Murat. *Certain improvements in machinery for shearing mechanically the military pom poons and other articles of the same kind.* Dated August 21, 1861.

Here the article to be sheared is held in a tube at the end of a horizontal spindle caused to revolve slowly by cords and pulleys, so that the article to be sheared has only a rotary motion round its horizontal axis. The tool carrier or holder is mounted on a horizontal shaft, and consists of a regular prism, having six sides or faces, on each of which is a blade or cutter. The tool carrier spindle, which is supported at two places, is caused to rotate rapidly by strap and pulley. The blades or cutters in rotating come nearly in contact with a fixed plate or counter cam, which supports the thread or filaments of wool or to be cut. This plate or counter cam is fixed in a carriage, and the tool holder is also placed on this same carriage, which is moved along by a screw. Or it may be moved round the article to be cut by causing it to revolve (by a handle) in a circular path. The machine will shear cylindrical, conical, or spherical articles. *Patent completed.*

2090. A. Jervis. *Improved machinery for the manufacture of pleated, ribbed, and looped fabrics.* Dated August 21, 1861.

Here the warp is divided so as to form two distinct and separate sheds, which may be called the upper and lower sheds, which pleated or ribbed fabrics are capable of being woven into distinct cloths, but are connected together at certain points, and so as to produce the desired ribbed or fluted appearance. The weaving operation is carried on in an ordinary loom, in which there are two shuttles used; or rising and falling or rotating shuttle boxes may be used for the purpose, either of bringing up the proper shuttle (if two or more are used), or if bringing the single shuttle opposite to the shed which is to be woven into cloth. *Patent abandoned.*

2091. T. Green and R. Mathers. *Improvements in apparatus for transmitting motion to machinery.* Dated August 21, 1861.

Here when transmitting motion from one grooved or plain pulley to another grooved or plain pulley by an endless band or strap, an intermediate pulley on which is interposed so that the opposite parts of its periphery are in contact with part of the periphery of the driving pulley, and part of the periphery of the pulley which is driven. When the driving and driven pulleys are grooved to receive the endless band, the periphery of the intermediate pulley or wheel may be plain or grooved, and be in contact with corresponding plain or grooved parts of the peripheries of the driving and driven pulleys; but when the parts of the peripheries of the driving and driven pulleys where the endless band acts are plain, then those parts of their peripheries which are in contact with the opposite sides of the interposed pulley or wheel are to be grooved or suitably formed to work in a groove or grooves formed in the periphery of the interposed wheel or pulley. *Patent abandoned.*

2092. T. Graham. *Improvements in the construction of boats, rafts, and other floating structures.* Dated August 21, 1861.

The floating or under portion of these boats or rafts is to be formed in two, three, or more longitudinal sections, say ribbed troughs of iron, or any suitable material placed alongside and apart from each other, and are to be so fitted as to receive and be firmly attached to and support a deck or floor projecting beyond the outside lines of these troughs, and this deck or floor is to be of a strength sufficient to support the cabins or coverings necessary for the protection of the passengers and cargo, and to protect these floating troughs from the effect of concussions at wharves, or in passing other floating bodies, the troughs are to be formed at stem and stern on the angle of exit and entry best fitted for progression through the water on which they are to navigate, and of strength sufficient freely to resist the pressure to which they must be subjected when submerged by the weight of a full cargo placed on the deck or carrying platform of which they form the support; for further security these troughs are to be divided from stem to stern crossways or longitudinally into such a number of water-tight divisions as to make submersion, without an almost total destruction of the troughs themselves, almost impossible. *Patent completed.*

2093. W. Richards. *Improvements in rifles and projectiles.* Dated August 21, 1861.

Here, in constructing breech-loading rifles (more especially double rifles) the patentee forms the stock in two parts, and hinges or joints the parts at a point a few inches in advance of the breech ends of the barrels. The front portion of the stock carries the barrels (if two are used) which, although connected are not fixed to it, being capable of sliding freely a short distance. The butt portion of the stock has a plate fixed to it with projections or plungers upon it, which when the piece is ready for firing enter and close the breech ends of the barrels; this portion of the the stock also carries immediately behind the joint beforenamed a vertical axis, which at its upper end terminates in a cam immediately under the barrels, and on the lower end of the axis is a lever by which it can be turned. On the under side of the barrels is a projection, which, when the barrels are brought up into a position for firing, comes just behind the cam, and then by turning the handle on the axis of the cam the barrels are forced back, the plungers on the breech plate entering the barrels, and carrying forward the cartridges (which in loading the piece have previously been placed in the ends of the barrels) into their proper positions in the barrels. The invention also comprises a method of manufacturing projectiles for breech-loading fire arms the details of which we cannot quote here. *Patent completed.*

2094. J. Kane. *Improvements in treating flax, hemp, and other analogous substances which yield fibres, for the purpose of manufacturing from them fibres adapted to be spun into yarn and thread.* Dated August 21, 1861.

Here the flax-straw, hemp-straw, &c., that yield fibre, are, when being steeped in water, to be subjected to the action of certain ingredients which have for their object to induce or hasten the putrefaction of the nitrogenous and gummy matters which surround the fibres in their natural state. These ingredients, which may be used in a solid or liquid state, consist essentially, of a nitrogenous substance or substances containing phosphoric acid or phosphates, or to which these latter are added, and which will produce ammonia by putrefaction, such as ground bones and guano, a solution of glue to which phosphates of soda or any soluable phosphate is added, or yeast. The patentee sometimes uses a solution of a soluble phosphate and carbonate nitrate or caustic ammonia or other salt of ammonia only. *Patent completed.*

2095. A. I. Mahon. *Improvements in screw or spiral propellers, also applicable to raising and forcing water.* Dated August 21, 1861.

This consists in having the blade, of whatever form it may be (screw or otherwise), so constructed that it shall strike water, while working, at any angle that may be desired throughout its extent, and irrespective of its pitch, and also that, spaces being left next the parts of the blade placed angularly, water may pass freely through all parts of the said blade, and will be held within the perimeter of else formed by the revolution of the blades. *Patent abandoned.*

2096. J. H. Johnson. *Improvements in the preparation of pulp for paper.* (A communication.) Dated Aug. 22, 1861.

This consists in manufacturing paper pulp from damaged hay, the residuum or pulp of beet root from sugar manufactories, and wrack grass. We cannot here give the details of the process employed. *Patent completed.*

2097. B. Samuelson. *Improvements in harvesting machines.* (Partly a communication.) Dated August 22, 1861.

This consists in a method of constructing harvesting machines, whereby the grain or grass, after having been severed by cutters, which breast the crop, is removed out of the track by mechanical means. The details are voluminous. *Patent abandoned.*

2098. E. Laudsberg. *Improvements in porte-robes or buttons for holding up the skirts of ladies' gowns.* Dated August 22, 1861.

This has reference to a previous patent, dated 13th Feb., 1860 (No. 387). This porte-robe or button for holding up the skirts of ladies' gowns, instead of having only one end of the braid, tape, cord, string, or other tie fixed to, and partly coiled round the barrel in the inside of the button, has the same doubled, and both free ends fixed to the barrel, whilst the remainder forms a loop, into which part of the skirt may be introduced, and kept fixed by a runner or slide gliding along the braid, tape, or other tie, which runner or slide may serve likewise for regulating the length of tape, string, or other tie, allowed to protrude beyond the button or stud. *Patent abandoned.*

2099. R. Telford and J. Sanders. *A substitute for castors for furniture.* Dated August 22, 1861.

This consists of a kind of shoe with a smooth rounded bottom or bearing surface in substitution for ordinary castors. The shoe consists of a socket, similar to the upper part of an ordinary castor, in which the leg of the piece of furniture is fixed, or a plate screwed thereto, and a solid piece of metal, earthenware, glass, or other material, with a rounded smooth surface at the bottom is inserted in the lower part thereof. *Patent completed.*

2100. L. M. Casella. *Improvements in mercurial thermometers.* Dated August 22, 1861.

This invention was described at page 296, No. 149, of this Journal. *Patent completed.*

2101. T. F. Doyle. *Improvements in means or apparatus for raising and forcing fluids.* Dated August 22, 1861.

Within a segmental chamber the patentee applies a pair of surfaces, acting together and radiating from a common centre, whilst they are capable of motion therein, so that alternately in the motions given to such surfaces by an excentric, or other means, space may be formed to receive fluid into such chamber, first on one side, and then on the other, and then to force such fluid therefrom through suitable valves and passages. The moving surfaces are made true to the chamber in which they move by packing, or otherwise, in order to their being fluid-tight. *Patent completed.*

2102. W. Baines. *Improvements in the construction of girders, frames, or other apparatus fixed or movable, and for certain peculiar forms or sections of iron used therein.* Dated August 22, 1861.

In the forms or sections of plates used in the construction of these frames or compound girders, one part of each is male, and another female; by bringing these parts together they become inserted, and being secured by bolts or rivets, effect a vertical union and continuous bearing, branching or extending where required. In constructing the movable parts of railway turntables the patentee bends and forms the plates into suitable parts or segments, and secures them in their respective places by bolts or rivets, thus constituting one entire frame forming its necessary cross girders which can be produced to suit any angle, for any number of roads, upon the table. *Patent completed.*

2103. T. Richardson and R. Irvine. *Improvements i the manufacture of paper.* Dated August 22, 1861.

This consists in applying in the manufacture aluminous cakes, obtained by acting on pit or alum shale or blues, either in a natural or roasted state, or on those ashes of bituminous minerals, which consist chiefly of silicate of alumina with sulphuric acid, in substitution of the alum or aluminous cake. *Patent completed.*

2104. J. Whitworth and W. H. Hulse. *Improvements in sights for small arms and ordnance, and in fitting apparatus used with small arms.* Dated August 23, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2105. M. Blakey. *Improvements in rotary pumps.* Dated August 23, 1861.

These improvements consist in a hollow cylinder containing in its inside two or more pump barrels, arranged radially and diagonally opposite each other, each pair of which pump barrels are connected and worked by one ram, moving in a diagonal direction. This cylinder being inserted in a ring with two outlets, which outlets are partially connected by slots in the interior surface of the ring, receives a rotary motion. *Patent abandoned.*

2106. J. Dunn. *An improvement or improvements in reaping machines.* Dated August 23, 1861.

Here from a basket fixed on the side frame of the carriage is suspended a bent oscillating lever, the lower end of which is connected with the cutters; the said lever carries two pulleys placed at equal distances, one above and the other below the centre pin on which the lever moves and is suspended. To the spokes of the carriage wheels on its inner side is fixed a circular rack, with which the said pulleys jar; as the wheel revolves, these pulleys traverse the teeth or projections on the said rack and thus communicate to the said lever and teeth a reciprocating motion. By an ordinary slide lever the said pulleys may be put out of gear when the knives are not required to be in use. *Patent abandoned.*

2107. A. B. Childs. *An improvement or improvements in the dressing of millstones, or what is generally known as the cracking of millstones.* (A communication.) Dated August 23, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2108. S. Elson. *Improvements in apparatus for heating the feed-water of steam boilers, superheating steam, and surface condensation.* Dated August 23, 1861.

Here the patentee proposes that the water shall first be heated by the exhaust steam of the engine, whence it is to be forced by pumps into suitable cylinders placed in the flues leading to the chimney, the water becoming further heated by the waste heat from the furnace of the boiler. A tube or pipe of small diameter open at the lower end, conveys the water to the bottom of each cylinder, and is so arranged as to pass through their interior, whence the water continues its passage within the cylinders to the feed pipe which conveys it to the boiler. The cylinders are kept free from the accumulation of soot or dirt by chains or bands passing partly, entirely, or more than one turn round them from end to end, where their extremities are attached to wheels rotating at either or both ends of the cylinders by a shaft and cog wheels. These chains or bands thus scrape or rub off the soot or dirt as it lodges on the exterior of the cylinders, rendering them more capable of absorbing heat and conveying it to the water. These cylinders in like manner serve for the purpose of superheating steam. The cylinders may also be made useful for surface condensation. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 29, 1861.

2702. J. Watt, 35 Lorrimore-street, Walworth, chemist, and T. S. Haviside, 69 Cornhill, gentleman. Improvements in the manufacture of soap.

Dated Jan. 17, 1862.

126. B. Moss, Liverpool, merchant. The application of steatite, either alone or in combination with other substances, to the manufacture of bricks, fire bricks, the lining of furnaces, and other similar purposes.

Dated Feb. 11, 1862.

356. W. Wood, Monkhill, Pontefract. Improvements in the process of manufacturing pomfret or liquorice cakes.

Dated Feb. 13, 1862.

384. T. Davison, Belfast, engineer. Improved means for preventing the corroding of steam boilers.

Dated Feb. 15, 1862.

403. T. Renison, Glasgow, plumber. Improvements in water closets.

404. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in electro-magnetic time-keepers. (A communication.)

407. J. Wall, plumber, and T. Dodd, Liverpool, glass merchant. Improvements in the construction and arrangement of apparatus for regulating the flow or passage of fluids.

409. T. Horsley, 10 Coney-street, York. Improvements in apparatus for turning and closing the cartridges of breech-loading fire-arms.

410. J. Cooke, Willington, Durham, mining engineer. Improvements in the method of propelling ships and other vessels.

411. D. R. Kyle, Victoria-street, Westminster. An improved method of communicating or signalling in and with railway trains.

413. S. Chatterton, Highbury, engineer, and W. Smith, Dalston, electrician. Improvements in telegraph cables.

417. J. Russell, Westbury Villa, Camberwell, master mariner. Improvements in the method of raising sunken, submerged, or stranded vessels.

Dated Feb. 17, 1862.

419. H. Crawford, J. Crawford, R. Crawford, and R. Templeton, Beith, N. B. Improvements in looms for weaving.

421. J. Whitaker, Leigh, Lancaster, agricultural implement maker. Improvements in machinery or apparatus for pulping roots.

422. J. J. Van den Berg, Hague, Netherlands, manufacturer. A new fire lighter.

425. J. Combe, Belfast. Improvements in machinery for winding cops, and in the treatment of cops for warps and other purposes.

Dated Feb. 18, 1862.

427. J. H. Hastings and J. Freezer, Holkham, and J. Woods, jun., Wells, Norfolk. Improvements in ploughs.

428. R. Watkins, 14 Lower Belgrave-place, Pimlico. Improvements in oil and spirit lamps, and in the means of producing light therein, parts of which improvements are applicable to lamps generally.

431. W. Clark, 53 Chancery-lane, engineer. Improvements in gas apparatus used for lighting cigars and other tobacco. (A communication.)

432. M. Henry, 84 Fleet-street. Improvements in cartridges. (A communication.)

433. W. Bush, Tower-hill, C.E. Improvements in omnibuses and other carriages.

Dated Feb. 21, 1862.

460. R. H. Skellern, South-terrace, Hatcham-park, Surrey, gentleman. An improved self-inking hand stamp or press.

462. J. Standish, Egerton, near Bolton, and J. Gooden. Improvements in machinery or apparatus for stripping or cleaning the flats of carding engines.

Dated Feb. 22, 1862.

470. W. Ashton, Manchester, machinist. Certain improvements in machinery or apparatus employed in the manufacture of braids and similar articles.

472. J. Kirkwood, Paisley, manufacturer. Improvements in looms for weaving.

474. J. Millington, Oaken-gates, Salop, timber merchant and builder. A new or improved hearse or bier.

476. C. H. J. W. M. Liebmann, Huddersfield, York, merchant. Improvements in felted fabrics suitable for carpets and other similar purposes, and in the apparatus employed therein.

480. G. Blakey, S. Blakey, and J. Blakey, Liverpool, boot top and legging manufacturers, and R. White, Birkenhead, boot and shoe dealer. Improvements in leggings or gaiters.

484. M. A. F. Mennons, 39 Rue l'Echiquier, Paris. Improvements in burners for heating by gas. (A communication.)

Dated Feb. 24, 1862.

486. G. West, 1 Chapel-place, Long-lane, Borough. Improvements in the construction of washing machines.

490. T. Blair, Carlisle, tea and coffee dealer. Improvements in machinery or apparatus for cutting, chopping, and breaking refined lump sugar and other substances.

492. T. N. Kirkham, West Brompton, and V. P. Ensom, Highgate. Improvements in bleaching and dyeing yarn and thread when in the form of cops or otherwise wound.

498. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the joints or chairs of the permanent way of railways. (A communication.)

Dated Feb. 25, 1862.

500. J. Woodrow, Oldham, hat manufacturer. A certain improvement in the manufacture of hats or coverings for the head.

402. J. Piddington, 52 Gracechurch-street. An improved machine for shelling or husking all kinds of grain. (A communication.)

504. E. Bliss, 36 Percival-street, Clerkenwell, jeweller, and H. Lamplough, 113 Holborn-hill, chemist. Improved means for viewing microscopic photographs and other minute objects.

Dated Feb. 26, 1862.

518. G. Davies, 1 Serle-street, Lincoln's-inn, C.E. Improvements in emptying or draining the water from careening docks in maritime ports. (A communication.)

520. A. D. Duparet, Paris, France. Improvements in the ornamentation of tissues.

522. J. H. Bennett, Blackburn. Improvements in steam generators, and in engines to be worked by atmospheric pressure or steam and air combined.

524. J. Cliff, Imperial Potteries, Lambeth. Improvements in glazing stoneware, red clayware, porcelain, and other kinds of earthenware.

526. C. L. Knoll, 187 Tottenham-court-road. Improvements in pianofortes.

528. E. Bruzand, Pembroke-road, Kensington. Improvements in pianofortes.

530. J. Medhurst, 53 Lower Queen-street, Rotherhithe, shipwright. Improvements in apparatus for reefing and furling the top sails, courses, and other square sails of vessels.

Dated Feb. 27, 1862.

532. G. Torr, Bucks-row, Whitechapel, animal charcoal manufacturer. Improvements in and an improved apparatus for manufacturing and reburning animal charcoal.

534. C. Clark, 361 City-road. Improvements in tea and other trays for the table.

538. Sir C. T. Bright, Victoria-street, Westminster, C.E. Improvements in electric telegraphs, and in apparatus connected therewith and employed in the manufacture thereof.

542. W. S. Wood, Larchfield Foundry, Leeds, engineer. Improvements in valves for regulating the flow of steam, water, or other fluids, and in means or apparatus for working or actuating them direct from the governor, or when worked by expansion cams in connection therewith.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

573. P. Remond, 39 Rue l'Echiquier, Paris. Improvements in double rein bridle bits. Dated March 3, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2691. W. Taylor, joints or connections.

2702. J. Watt and T. S. Haviside. Manufacture of soap.

2708. W. H. Furlonge. Condensation of steam.

2726. E. De Bassano and A. Brudenne. Manufacture of stearine.

2733. G. Norman. Cots or cradles.

2742. J. Higgins and T. S. Whitworth. Preparing fibrous materials for spinning.

2744. R. Mushet. Cast steel or homogeneous iron.

2755. T. Walker. Cables or chains.

2757. J. French. Doubling or twisting.

2759. S. Osborne. Hooped skirts.

2763. T. Spencer and T. Robinson. Making pipes. (Partly a communication.)

2771. J. Ashley. Attaching horses to carriages.

2772. R. Wilson. Steam hammers.

2775. W. Hall. Production of lace.

2777. R. Fethney. Preparing, spinning, or doubling cotton.

2790. P. G. Stuber. Measuring the humidity of the atmosphere.

2801. J. Barrow. Manufacture of benzole.

2804. H. Montucci. Goffering.

2814. R. McNair. Stitching machines.

2821. E. Loysel. Match boxes.

2831. W. J. Hay. Protecting ships.

2837. G. Davies. Bleaching. (A communication.)

2852. J. Booth, T. W. Chambers, and J. Chambers. Weaving.

2996. S. Amphlet. Ornamenting surfaces.

3015. E. Tyer. Electric telegraphs.

3028. J. H. Glew. Sewing or stitching.

3033. W. Duchemin. Blocks for hoisting.

3220. J. F. Harvey. Umbrellas and parasols.

3270. W. E. Newton. Obtaining motive power. (A communication.)

99. J. G. Marshall. Preparation of fibres.

111. J. G. Marshall. Producing fibres.

116. H. D. P. Cunningham. Protecting screw propellers.

162. W. Tozer and A. Head. Boots and shoes.

226. W. E. Newton. Pumping or forcing air or water. (A Communication.)

231. F. D. De Boutteville. Spinning fibrous substances.

233. J. McKean and J. Gabbott. Sizeing or dressing yarns.

275. P. W. Daehne. Manufacture of zinc.

327. A. McKenzie and F. Panthel. Sewing machines.

355. W. Lyall. Preparing fibrous substances.

396. S. B. Whitfield. Bedsteads.

427. J. H. Hastings, J. Freezer, and J. Woods. Ploughs.

460. R. H. Skellern. Self-inking stamp or press.

509. J. Imray. Hinges.

538. Sir C. T. Bright. Electric telegraphs.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated March 7, 1862.

2245. G. Malcolm.
2248. P. B. O'Neill.
2257. J. Smith.
2260. W. L. Thomas.
2274. W. H. Delamare.
2276. R. Smith, B. Brooks, and J. Smith.
2280. T. L. Murray.
2288. R. Waller.
2289. W. Wheatstone.
2340. W. Clark.
2344. J. Graham.
2441. P. A. F. Robert.
2475. P. Knowles.
2803. B. Dobson and J. Clough.
3188. J. Smith, and J. B. Higgs.
3260. W. Tongue.
3262. W. Tongue.

Sealed March 11, 1862.

2264. W. Steevens.
2272. W. Davis.
2273. W. Farlar.
2279. R. A. Brooman.
2282. C. Sutton.
2283. H. Dixon and J. R. Renner.
2285. G. Dixon.
2292. F. Barnett.
2303. J. Reeves.
2304. T. Meriton.
2308. W. Stewart.
2310. R. A. Brooman.
2313. W. Tuxford.
2345. S. Hawksworth.
2389. J. Musgrave.
2466. T. Warwick.
2520. G. Davies.
2800. W. A. Shepard.
2974. D. Ker.
2997. H. Wilde.
3201. W. M. Williams.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

580. J. Leigh.
584. W. P. Savage.
598. J. P. Clark.
601. A. and A. Booth.
610. J. A. Williams.
612. A. Taylor.
643. T. Lightfoot.
655. J. Dixon and E. Clayton.
617. T. Patstone.
670. H. Bessemer.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

504. J. Cooper.
505. W. Weild.
538. S. C. Lister.
618. W. Smith.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending March 8, 1862.

No.	Pr.		No.	Pr.		No	Pr.		No.	Pr.		No.	Pr		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
1885	0	11	1898	1	0	1911	0	3	1924	0	3	1938	0	9	1951	0	3
1886	0	5	1899	0	10	1912	0	5	1925	0	10	1939	0	7	1952	0	[illegible]
1887	0	4	1900	0	3	1913	0	3	1926	0	5	1940	0	5	1953	0	[illegible]
1888	0	6	1901	0	3	1914	0	7	1927	1	2	1941	0	6	1954	0	3
1889	0	3	1902	3	8	1915	0	3	1928	1	0	1942	0	10	1955	0	[illegible]
1890	0	6	1903	0	3	1916	0	10	1929	0	7	1943	1	[illegible]	1956	0	[illegible]
1891	0	10	1904	1	5	1917	0	3	1930	0	3	1944	0	10	1957	0	[illegible]
1892	0	3	1905	1	11	1918	0	7	1932	0	7	1945	0	1	1958	0	[illegible]
1893	0	3	1906	0	10	1919	0	10	1933	0	7	1946	0	7	1959	0	[illegible]
1894	1	1	1907	0	5	1920	0	3	1934	0	5	1947	0	3	1960	0	[illegible]
1895	0	3	1908	0	3	1921	0	10	1935	0	3	1948	1	4	...		...
1896	0	3	1909	0	3	1922	0	7	1936	4	2	1949	0	3	...		...
1897	0	10	1910	0	3	1923	0	3	1937	0	6	1950	3	7	...		...

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, March 13, 1862.

		£	s.	d.		£	s.	d.	
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	6	0	0	nett
Welsh Bars, in Wales	„	5	5	0	„	5	7	6	„
Staf. Bars, at the Works	„	5	10	0	„	7	5	0	„
„ Hoops	„	7	10	0	„	8	0	0	„
„ Sheets, Singles	„	9	0	0	„	9	0	0	„
„ Nail Rods	„	5	15	0	„	6	10	0	„
„ Boiler Plates	„	8	0	0	„	8	10	0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	9	0	„	2	9	3	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	0	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	93	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	97	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9½	„	0	0	0	„
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	16	0	0	„	0	0	0	„
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	6	1	0	„	0	0	0	net
„ Straits	„	5	17	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I.C.	„	1	1	6	„	1	4	0	„
LEAD:									
Pig, English	pr. ton	20	5	0	„	21	10	0	2½
„ Spanish	„	20	0	0	„	21	0	0	„
Common Sheet	„	21	10	0		22	0	0	„
Tea „ (Wimshurst's Patent) A special disct...	„	35	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	19	0	0	„	0	0	0	nett
For arrival	„	18	5	0	„	18	7	6	
ZINC:									
English Sheet	„	24	0	0	„	0	0	0	1
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	3

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 21, 1862.

NAVAL ARCHITECTURE.

THERE is a perpetual charm in a ship for us British people, and in the progress of the shipbuilding art we shall never lose interest. "There is not," says Mr. Ruskin, "anything in nature so absolutely notable, bewitching, and, according to its means and measure, heart-occupying as a well-handled ship under sail on a stormy day." And again: "Take it all in all, a ship of the line is the most honourable thing that man, as a gregarious animal, has ever produced. . . . Into that he has put as much of his human patience, common sense, forethought, experimental philosophy, self-control, habits of order and obedience, thoroughly wrought hard work, defiance of brute elements, careless courage, careful patriotism, and calm expectation of the judgment of God, as can well be put into a space of three hundred feet long by eighty broad. And I am thankful to have lived in an age when I could see this thing done."

This may at first sight seem very high-flown to some readers; but if they will consider it well, they will soon discover that a modern ship, and especially a large modern steam-ship, is in truth an embodiment of many very exalted human achievements. When the founders of the Institution of Naval Architects established that body, with the intention of promoting "the improvement of ships, and of all that specially appertains to them," they commenced a task which ramifies itself into many of the widest and loftiest regions of human knowledge. The very first calculations that the naval architect has to make involve some of the subtlest uses of geometry. Before he can predict the behaviour of his vessel at sea, he has to penetrate many profound laws of fluid action. In the wise disposal of her sails, he must exercise an intimate knowledge of mechanics also. In furnishing her with a steam-engine and propeller, he has to regard still more subtle laws and principles. In supplying her with anchors and cables, he should bring a sound knowledge of the varying qualities of iron to bear. In equipping her with compasses, all the information we possess concerning magnetism should be brought into use; and so forth We do not say, of course, that all these requirements are indispensable to the construction and equipment of a ship; for we know full well that hundreds of ships are built and sent to sea without regard to them; but it is nevertheless manifest that the perfection, and even the steady improvement, of our ships, can only be accomplished by an incessant study of all these and many other branches of knowledge.

If we consider what has already been done by the new Institution for improving naval architecture, and what it proposes to do in the congress that will assemble at the Society of Arts next week, we shall see how true the above reflections are. In the two volumes of its *Transactions* now before us—of which the second has recently been issued, and is an improvement upon the first—we have complete, and apparently verbatim, records of its public proceedings in 1860 and 1861; and from them we find that the following subjects have been considered: The present state of the mathematical theory of naval architecture—embracing, of course, many profound physical and mathematical considerations; the strength of iron ships, including the nature of the metal employed, and its distribution throughout the structure; the same as regards wooden ships; the laws of compass deviation and correction; the measurement of tonnage; the manufacture of chain cables; means and appliances for economising fuel in steam ships; and the form of least resistance for the submerged portions of ships. All these subjects, many of them of a most subtle and embarrassing character—are discussed in the first volume. In the second are considered the various complicated questions opened up by the introduction of iron armour for ships of war; the singular mechanical combinations resorted to in American river steamers, to obtain large accommodation in vessels that scarcely penetrate the water at all; the difficult geometrical problems involved in the measurement of the statical and dynamical stabilites of irregular floating bodies; the still more difficult physical and mathematical problems involved in the rolling motions of ships; the production of iron ships that shall be practically unsinkable; the best forms of ships as regards resistance; and the abstruse principles of compass disturbance. In the programme of proceedings for next week, which we to-day place before our readers, they will find that several of these subjects will then undergo further inquiry, and that a variety of other scientific investigations will be entered upon.

All this establishes the truth of our two propositions, viz.; that the study of naval architecture is of immense interest to us as a great maritime nation, and also that it embraces an extremely wide area of theoretical and experimental research. We think it also shows how incumbent it has been upon us to recognise the necessity, the claims, and value of the Institution of Naval Architects.

We shall now content ourselves with offering a few remarks upon the programme for next week's meetings. The first thing that will strike the reader on glancing over it will be the renewal of the discussion upon iron-cased ships, and upon ships of war generally, to which the first meeting is to be devoted. If this discussion were to be directed to the general problem, we should be disposed to complain of it, because we doubt if any of the gentlemen announced to speak upon the subject are able to add anything of much value to what was said in the same place last year, and is now before us in the volume just mentioned. Fortunately, however—and, we are bound to say, judiciously—it is to the points then left undebated, and concerning which additional information has been acquired since March last, that attention is now to be given. These points are, the sailing and steering qualities of ships of war, and the armour plates of iron-cased ships. It cannot be doubted that Mr. Cunningham, Captain E. P. Halsted, R.N., Rear-Admiral G. Elliot (one of the very first sailors in the service), Rear-Admiral Woodford Williams, Captain Cowper Coles, R.N., Captain J. Ford, of the Thames Iron Works, Mr. Fincham, Mr. Brown, of the Atlas Works, Sheffield, Sir J. C. Dalrymple Hay, and Mr. W. Fairbairn—all of whom are to speak upon one or more of these questions—will be able to throw much useful light upon them. We are pleased to observe that the members, and even the chairman (Sir John Hay), of the Government Iron Plate Committee, have agreed to be present and take part in the debate. On the evening of the same day a series of papers on iron ships will be read. In the first, Mr. Scott Russell will give a description of his longitudinal system of construction in its latest form, as applied in a ship recently launched at Millwall; in the second, Mr. J. Grantham will impart some information, which is likely, we think, to be very valuable, concerning the practical questions of jointing and riveting iron ships; and in the concluding one, Mr. Charles W. Lancaster will communicate some very novel and promising facts regarding the preservation of the bottoms of iron ships—a subject which, if Lord Clarence Paget is to be believed, only requires to be satisfactorily settled in order to bring about the general introduction of iron ships into the Royal Navy. We happen to know that Mr. Lancaster has given much attention to this subject, and with great success. There is only one exception which we feel bound to take to the proceedings of the day, and that consists in the absence of a good paper for the morning meeting from some competent naval architect. It is not possible, we believe, for naval officers alone to deal satisfactorily with the questions of masting, rigging, sailing, and steering. They may, as we have said, convey valuable information on each of these heads; but they cannot be expected to dispose of the scientific considerations that are involved in all of them. Probably, however, these will be best dealt with after the naval men have had their say.

As regards the Friday morning meeting, no one can doubt the interest that will be thrown into the discussion upon the rolling of ships, by such a man as Dr. Woolley, and by his former pupil, Mr. Crossland. Dr. Woolley has already achieved the highest distinction attainable as a writer on naval science; and Mr. Crossland is certainly one of the most able members of the late School of Naval Construction, at Portsmouth. The paper on the propulsion of steam vessels, by Mr. J. Simon Holland, of the steam branch of the Admiralty, will be directed, we believe, to the refutation of numerous errors that prevail among engineers and others, especially as regards "slip." We have no doubt that it will be a very valuable communication. On the evening of this day, the three most competent persons in the kingdom, as regards the compass question—a question of the highest importance—will discourse upon that subject. Mr. Archibald Smith, who has undertaken to expound the mathematics of the subject, has wisely arranged to base his exposition upon facts and experiments which he will exhibit to the audience; and he will be followed by Mr. Evans, of the Admiralty, and Mr. Rundell, of Liverpool, who will respectively show the practical bearings of the subject upon the ships of the royal and mercantile navies. Mr. Evans will, we believe, explain the results of observations made on board H. M. iron-cased ships Warrior and Defence.

At the concluding meeting a number of miscellaneous papers will be read, from which we may select one for special mention. We refer to that on the construction of marine steam boilers, by our old and valued correspondent, Mr. Charles Wye Williams, of Liverpool. From Mr. Williams—who is our one great authority on boiler construction in this country, and whose practical experience is as extensive as his theoretical knowledge—we anticipate a most instructive essay. The much-vaunted "tubular system" will doubtless meet with a critical examination, and we hope that the wasteful expenditure of fuel now going on in nearly all our large and costly steam-ships, will be dealt with unsparingly. We shall also look to Mr. Williams for practical suggestions, which may be acted upon with advantage by the engineers into whose hands these ships have passed from the contractors.

On the whole, we may congratulate the Institution upon the programme which it has put forward for its third year's meetings, for it shows that its promoters are well able to maintain the high ground which they so boldly assumed at first. We see not the slightest symptom of decline in any department of its labours, and we have been informed that financially, as well as professionally, it is in a flourishing condition. Its exact circumstances, in this respect, the promised report will explain.

THE PUNKHA.

Though comparatively unknown in this country, there is no one word which is more familiar to Europeans in British India than "punkha." There is no word in use in that part of Her Majesty's dominions either, which conveys to English residents a more vivid idea of comfort than it does. For fully eight months in the year the punkha—or gigantic fan as it may be termed, is literally "in full swing" in India. Were it not to be so disease and death would march hand in hand throughout the country, unchecked and uncontrolled, and it would become a vast European cemetery. The punkha saves the lives of thousands of persons annually in India, and is is consequently regarded, as we have said, and no wonder, with the utmost respect by all who have not been born and nurtured under the burning suns of India. In all private dwellings the punkha is an adjunct to the domestic arrangements, which is never absent, and except for a brief period in the year, never at rest. In public institutions, such as hospitals and barracks, for example, it is indispensable. Without the punkha the Medical Man and the Sanitary Commissioner would be impotent for good, and our troops would find it a quick march from the barracks to the grave-yard. Coolness of temperature must in short be obtained by artificial means, if European life is to be preserved in India, and the punkha is one of the chief means to that end.

The number of natives employed in punkha-pulling has hitherto been enormous. Thousands and tens of thousands of them appear to have come into existence for no other purpose than that of fanning away fever and pestilence from those who occupy their country, and who grow rich and bilious by means of its products and its climate. Now, however, a revolution in regard to the useful, but sedentary and unintellectual labours of the punkha-puller, is impending. Mechanical invention, indeed, is about to supersede generally, the literal hand-labour of native punkha-pullers, and, as a matter of course, their "occupation" will, like Othello's, under other circumstances, soon be "gone." The magician who is about to accomplish this change is an Englishman, Mr. Grant, a superviser in the public works department of the North-Western province of British India. Mr. Grant has boldly altered the form of the punkha, from that usually employed, and which tradition and long usage had made apparently unalterable. Other inventors had attempted to apply new mechanical apparatus for the working of old-fashioned punkhas, and they had always failed. Mr. Grant, more wise, has reformed the punkha, and adapted it to his new but simple machinery, and he has succeeded.

At the barracks of the Imperial Government at Benares, Mr. Grant's experiments have been tried on a large scale, and of these Captain Priestly, executive engineer at that place, reports favourably. The punkhas of our inventor consist of frames, six feet long and two feet wide, covered with cloth, and with a fringe attached to each. They are each hung by an iron rod, firmly fixed to the frame, and working on a pivot attached to the beam supporting the punkha. The extremity of the end is not at the pivot, but continued above it for eighteen inches. The usual ropes are given as checks. The punkhas are connected by iron wire fastened respectively to these rods at two points: one the upper extremity of the rod above the pivot, and the other at the same distance from, and below the pivot. The wires of the end punkhas are not led directly to the machine, but are first attached to a rod working in a slot in the wall.

So much for the hanging, and now for the pulling apparatus. From the extremity of the rod, or lever in the wall, wires are carried connecting each end with the vertical arm of a bent lever. The horizontal and longer arms of these levers are weighted, so as to form a counterpoise to the weight of the number of punkhas to be worked A simple and yet ingenious arrangement increases the weight of the descending treadle, and lessens that of the ascending one. A moveable weight connected with the produced extremity of each, flys out when it commences its ascent, and returns towards the fulcrum when it descends, thus giving increased power. The pulling machine takes up but little room, and it is not easily put out of order. One coolie is sufficient to work it; by its aid he can accomplish, with little exertion, as much punkha pulling as by the old system it required twelve coolies to accomplish.

The economy of Mr. Grant's clever contrivances will be made more apparent by a comparison of them with the old system in use at the three barracks, and the hospital of Benares. In these there used to be 254 punkhas, drawn by 114 coolies, at a cost of 2,512 rupees for five and a half months. During the hot season of 1861, on the other hand, the same amount of punkha-pulling, at the same place, and on Grant's principle, was accomplished for 528 rupees, including the cost of each pulling machine, and that of the alteration of each punkha to suit the machines. No doubt the coolies will protest with native warmth against the introduction of punkha-pulling machinery; but in spite of them it will ere long be introduced universally throughout India, and, as in cases nearer home affected by the introduction of labour-saving appliances, they must bend to the breeze they cannot withstand. Possibly British enterprise will find in new cotton fields, or the prosecution of railway and other works, more productive modes of employment for the disengaged coolies than they have hitherto had. At any rate, we are certain that the change will be for the best.

ON FUEL.

Article VI.—Coke.

The term coke is applied to substances having very different properties; the variety which is obtained as a bye product in the manufacture of gas is a very inferior article, and is not capable of being usefully applied to any metallurgical or other manufacturing process, moreover, it usually abounds with undecomposed iron pyrites, the sulphur of which, burning freely when heated in the air, evolves a considerable proportion of sulphurous acid.

Coke as used in the various metallurgical operations, and as fuel for locomotives, is manufactured by several different processes, either in piles, coke ovens, or in kilns, as thus obtained, its characters vary considerably with the mode of manufacture, and the variety of coal from which it is produced.

Good coking coal should contain very little mineral matter, and the proportion that exists should be very infusible; if lime be present in conjunction with silica a vitrifiable ash is left, this, when melted by the heat of the combustion, burns out the bars, and produces a clinker which destroys the draught and seriously impedes the working of the furnace in which it is used.

The density, porosity, and relative degree of hardness of coke should vary with the purposes to which it is applied, being more or less readily combustible according to the circumstances under which it is required to be burnt. All the varieties, however, seem to have the same general composition; after having been dried at a temperature of 200° C., they contain rather more than 91 per cent. of carbon, about 6 per cent. of ash, and a small amount of nitrogen, oxygen, and hydrogen.

Exposed to the air under cover, coke absorbs a small amount of moisture, varying from 1 to 2½ per cent., and exposed to wet, or submerged in water, it is capable of absorbing in some cases as much as 50 per cent. of its own weight, the greater part of this is, however, lost if it is subsequently air-dried. But it should be borne in mind that the calorific effect of coke is very greatly lessened when it is used in a wet state.

The general principles of the process of coking may be thus stated. Coal when heated either in perfectly close vessels or in a limited supply of atmospheric air undergoes decomposition; at a comparatively low temperature inflammable gases are given off which abound in carbon, if these pass over a portion of the coal which is more highly heated they are decomposed, the excess of carbon being deposited, and the gas is converted into light carburetted hydrogen—this change explains the origin of the dense masses of carbon which are found lining gas retorts; the coal in the centre of the retort is at first but slightly heated, and it gives out heavy carburetted hydrogen, which is decomposed by contact with, and deposits its carbon on, the heated sides of the vessel.

When coal is coked in an oven, and the burning proceeds from above downwards, air being only admitted to play over the surface, the same effect is produced; occasionally beautiful specimens of almost metallic looking masses of carbon deposited in this manner may be obtained; not unfrequently this carbon is deposited upon the straw employed to ignite the gases first given off, and elegant filamentous groups of hard solid metallic-looking carbon, having the exact form of the straw, are then produced.

To account for the singular hair-like threads which are often seen on pieces of coke, Dr. Percy gives the following explanation:—"They "are solid, and present under the microscope "the appearance of a string of beads which "have been soldered together; they consist of "carbon, which seems to have been deposited "on bubbles of gas, one bubble being just produced, a second is then formed in connection "with it, and so on in succession, the tube becoming constructed at the junction of every two "bubbles; gas would continue to flow through "this tube depositing carbon on its inner "surface until the tube is converted into a "nearly solid fibre."

With regard to the different processes adopted for the manufacture of coke, the simplest is that of coking in piles or on hearths, this process is well described by Dr. Percy, and we shall avail ourselves of his information in the following account:—"In the centre of the pile "is a chimney, about 6 feet high, built of open "bricks, having spaces between, these are laid "without mortar, the heat being suffered to "cause them to unite by vitrification, the top "of the chimney is capable of being closed "with a damper, which can be made air-tight "by being covered with sand, the largest coal "is stacked against this chimney so as to form "a heap having a diameter of about 30 feet, the "smaller lump being placed above the larger, "the whole heap is then covered with coke "dust (the refuse of previous operations) except around the bottom of the pile. The "heap is fired at the top by putting live coals "into the chimney, burning proceeds from "above downwards, if it be too violent at any "part, it is damped by the application of coke "dust, and when coal smoke ceases to be "given out (usually in about five or six days) "the fire is extinguished by plastering the "whole oven with wet coke dust and closing "the chimney; about the tenth day the coke "is withdrawn, the pile having been first "watered to extinguish it. The yield of such "a pile is stated to be about 65 per cent. or 13 "cwt. of coke to the ton of coal; obviously, "therefore, a very considerable quantity of fuel "is burnt to waste."

The manufacture of coke in ovens yields an article of very superior quality. Very free from sulphur, dense and contracted into a smaller bulk, consequently it admits of the introduction of a greater weight of fuel into a small space, an object of great and obvious importance in all cases were an intense heat is required, this condensation is supposed to be partly owing to the pressure in the oven, and partly to the contraction of the material owing to the long continued heat to which it is exposed; hence in some cases the coke is kept in the oven for 96, or even a greater number of hours. Although this effect of long continued heat is denied by M. de Marsilly, who states, as the result of his experiments, that no advantage is obtained by continuing the process longer than 48 hours.

A coke oven, as usually employed, is simply a circular chamber, having a flattened arched roof, in which is an aperture, and a side entrance capable of being bricked up when the oven is in use.

The process adopted at several of the railway works, where very excellent coke is made for the use of locomotives, is as follows:—The ovens are charged with coal, which is ignited at the surface, taking fire readily from the heat radiated from the top of the oven, hence the greater part of the smoke is consumed even at the very commencement of the process; when the combustion becomes too rapid, the draught through the loose bricks of the doorway is checked by plastering it up with wet sand except at the upper part; this, however, is also closed after the charge has been in about 24 hours; in about 12 hours more the flame ceases to escape from the chimney, when the whole is damped so as to exclude the atmospheric air as perfectly as possible; in about 12 hours more, the operation is completed, when the doorway is opened, and the dense, hard, metallic-looking iron grey coke removed in the form of prismatic columns somewhat like those of Basalt. This process is much more economical than that of pile-burning, as good coals yield 80 per cent. of a superior coke against 65 per cent. obtained by the other process. The small amount of loss in oven coking results from the fact that the heat is chiefly produced by the burning of the volatile materials, and not from the combustion of the solid carbon, for the burning can only take place on the surface where air is present, and it is, therefore, the inflammable gases and vapours that are chiefly consumed.

The process of coking in kilns has been long known in Germany, and has been lately introduced into this country by Mr. Rogers. The kilns are long parallelograms open above, the walls are about five feet in height, and the coal is densely packed in the kiln, and covered over with wetted slack, closely stamped down. Air is admitted through apertures in the side walls, and the products of the partial combustion escape by chimneys built in the substance of these walls. The value of the process has been much debated; in Germany it is employed to coke slack coal, and the necessary openings to ensure the access of air to the interior are preserved by stamping the coal tightly around billets of wood, which are afterwards withdrawn through the side openings.

In England, where it has been employed with large coal, it has met with opposition in some quarters, and great support in others; the truth, in all probability, being that it is much better adapted to some varieties of coal then to all.

Those who are interested in the matter, will find the full details in a paper, communicated by Mr. Rogers to the Institute of Mechanical Engineers, at Birmingham, 1857. There appears no doubt but that with those coals to which it is adapted the plan is one of the most economical known, but it is evidently not suited to all varieties.

The production of coke from non-coking coal by admixture with pitch, coking coal, coal tar, &c., has been the subject of numerous patents. Mr. Bethell took out a patent, not proceeded with, in 1854, and again in 1858, and this process has been repatented over and over again. This is not surprising, as the problem of coking the non-caking Staffordshire coal is one of immense importance, a prodigious quantity of small slack is obtained in the Staffordshire mines, and left in the pits because it cannot be raised to profit. "I have no doubt," says Dr. Percy, "that should any one be so "fortunate as to succeed in converting this at "present worthless material into good coke at "a moderate cost, he would realise a large "fortune, and would moreover have the satis"faction of prolonging the industrial life of "South Staffordshire, which has already began "to suffer from the partial exhaustion of its "fuel." The only plan which appears to offer much prospect of success is that dependent on the fact we have already noticed in these articles, namely, that the thick, non-caking coal of South Staffordshire, can be made to produce a coherent coke by heating it rapidly in close vessels, at a very high temperature.

The peculiar coke ovens of the Brothers Appolt, now so largely in use in France, appears to act on this plan, in these the coal is subject to the process of coking in narrow vertical ovens, that are air-tight, having no opening except that through which the volatile products escape, and so far they resemble gas retorts, moreover each vertical compartment is surrounded with and heated by the burning of the gas given out during the process, so that a very extensive heating surface is obtained, several times greater than in any other oven, and the coal from its being divided into small masses is submitted to very rapid carbonization.

The contrivance of the Brothers Appolt is a most ingenious mode of coking coal by means of its own inflammable gases, and by its use it has been demonstrated that the gas given out is much more then sufficient to effect the operation.

The yield of coke is stated to be from ten to twelve per cent. greater than from any other process, the action is continuous, and mixtures of caking and non-caking coal have been employed with the best results.

The construction of the furnaces of the Brothers Appolt cannot be satisfactorily shewn without a series of engravings, therefore we must refer those who are desirous of investigating more fully the construction of this improvement on the ordinary method, either to "Percy's Metallurgy," where reduced drawings are given from the *Annales des Mines*, or to the separate publication entitled, "*Carbonization* "*de la Houille Systeme Appolt, decrit par les* "*Auteurs, M. M. Appolt Freres.*" Paris, 1858.

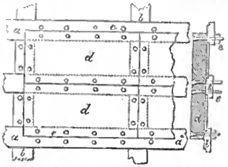
THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER. IV.

In these days when great national undertakings are founded on scientific principles, it is fortunate for the public purse that professional knowledge, mechanical skill, and practical experience, can meet on common debating ground in a popular periodical. Empiricism is exposed, official confidence checked, and truth elicited, by the free discussion of questions in which science and art play, or affect to play, a conspicuous part. Thanks to the ventilation in your columns of the subject of iron armour, its importance begins to be appreciated. Several of your correspondents have submitted plans, of which some appearing to possess originality or merit will be noticed, but it is impossible to include all in the limited space you can afford to one subject in your columns. I continue the description of the fastenings of armour plates by introducing another series of diagrams.

Fig. 12. Fig. 13.



Figs. 12 and 13 are a plan and vertical transverse section of a mode of fastening, proposed by Mr. Samuda, in a paper read at the Institution of Civil Engineers on the 28th January, and fully reported in the Mechanics' Magazine of the 31st January. *a*, *a*, are longitudinal ribs 16 inches wide and 2½ inches thick outside the frame work of the ship, and rivetted to it, the outer 4 inches on each side being recessed 1 inch. *b*, *b*, are vertical ribs of the same dimensions, between the former. The ordinary skin plate, *c* in Fig. 13, 1 inch thick, is rivetted in these recesses, so as to form a flat surface, on which the armour plates *d*, 5 inches thick, and corresponding in length and width to the distances from centre to centre of the ribs *a* and *b*, are fixed. The edges of the armour plates rest on and are fastened by rivets or bolts *e*, *e*, to these ribs, along the centre line of which the joints run.

The result of this arrangement is a system of panelling, of which the central parts of the armour plates, subdivided by the ship's timbers, are the panels, 6 inches in thickness, and the ribs the frames, 7½ inches in thickness. This mode of structure, forming hollow spaces under the panels, is similar to the arrangement of a plate intended to be perforated with a punch. Having no backing or support behind to resist the impact of a projectile, the panel will be penetrated, or driven inwards and bulged. In either case, the buts will be forced outwards, and fractured at the holding points, or will tear away the bolts, which are only an inch from the outer edge. If the joints receive the impact, the edges of the plates will be fractured at the bolt holes, or the bolts will be broken off. A large target on this plan has been ordered by the Admiralty, and is intended to be tried at Shoeburyness; but the experiment on the Iron Plate Committee's target has so conclusively decided that the fastenings of armour plates which are in contact with the skin of an iron ship, without protective backing, will not resist the concussion even of shells, and much less of solid shot, that it may be deemed expedient to introduce some modification in Mr. Samuda's system before exposing his target to certain destruction. It will probably also be perceived that Mr. Scott Russell's mode of armour plating, which makes no provision for an efficient backing to the plates, cannot fail to share the fate of the Iron Plate Committee's target. Figs. 14 and 15 are diagrams of an invention of Mr. Cooper, C.E. It is a mode of holding armour plates by means of large screw bolts, 4 or 5 inches in diameter, inserted at the joints between the panels, so that each bolt is screwed into, and holds the edges of two plates. *a*, *a*, are the plates; *b*, *b*, the screw bolt-heads, flush with the face of the plate; *c*, *c*, the semi-circular half of the bolt-holes at the edges of the plates. When the plates are in position the holes are drilled and tapped to receive the screws, on the thread of which, and not on the head, which is not conical, the holding power of the bolt depends. When the shock of concussion is thrown on these screw bolts, it is to be feared they will break in two, or strip at the threads, or more probably tear away the angles of the plate by which they hold on.

Fig. 14.

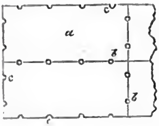
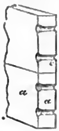


Fig. 15.



The main object in this plan, as in those of Mr. Samuda and Mr. Scott Russell, is to protect the plates from the effect of buckling by placing the fastenings at the outer edges; but in all these cases the cause of buckling, which simply is the indentation or yielding of the central parts of the plates when struck, seems to be lost sight of. The inventors, instead of contriving means to prevent buckling, by obviating the cause, have only thought of opposing it, and for that purpose have placed their fastenings at or close to the edges, where the effect of buckling is irresistible, and must destroy them. In all these plans, the holding parts, which are only one to two inches in thickness, are exposed to immediate impact and concussion, and two of them are in the decidedly objectionable form of through bolts, requiring perforation of the plates.

Fig. 16 and 17, in which *a* shows layers of iron plate and *b* rivets, are a representation of a plan proposed by Mr. Hawkshaw, the celebrated engineer, for forming thick plates by riveting thin plates together. The enormous expense of manufacturing the ponderous masses of iron, which the Government authorities consider indispensable for protective armour, no doubt suggested the idea of this plan; but it is hard to conceive that numerous perforations of rivet holes through plates would not weaken the iron or make it more susceptible to fracture by concussion. At a recent trial of a combined plate of this description carefully manufactured, the shot passed through and damaged the plate in the manner shown in Fig. 17; but as there was no body behind forming a backing or offering the slightest resistance to the penetrating or crushing effect, the experiment really decided nothing as to the capability of resistance of such a combined plate, if supported with an efficient backing; and it would be interesting to make experiments on such plates fixed on solid iron backing in order to ascertain if they will offer the same resistance as a plate of the same thickness all in one, which I am inclined to think would be the case.

Fig. 16.

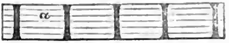


Fig. 17.

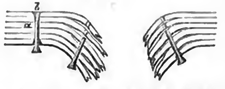


Fig. 18.

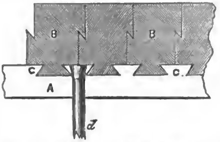


Fig. 18 is a diagram of a plan patented by Mr. Lancaster, but it is so similar to the mode of fastening the Thorneycroft bars already described in my second letter (Fig. 6) that it is only necessary to observe the points of difference, which are, that the stringers *A* are provided at the back with bolt fastenings *d* and the plates *B* instead of being tongued and grooved longitudinally are dovetailed at the sides, but the same causes of destruction exist in both plans. The concussion of impact on the face of a plate would drive it inwards, and force the dovetail at the back through the stringer, and also split the plate at the angles of the dovetails on the sides, in the same way as the tongues and grooves of the Thorneycroft bars were rent asunder, because this system affords no means of bringing the surfaces of the parts which compose the structure into perfect contact all over, or of so fastening them together as to prevent vibration or oscillation.

Mr. Robert Gray, of Woolwich, in a communication to the Mechanics' Magazine, proposes a tube 2⅜ inches in diameter, in lieu of a solid bolt, as a through fastening on the Warrior plan. As far as I am aware this is a novel idea, and may be found advantageous in its application; no modification, however, of the through bolt will compensate its inherent defects. The inventor thinks the conical head not being solid would not split the plate, and he probably is right; but, from the same cause, it might, when struck, collapse and lose its holding power. To give the tube greater solidity he suggests that it might be plugged with hard wood. The main object he has in view is to render the inside end of the tube available as the fastening of the bolt, in lieu of a nut and screw, by coning this end into a corresponding hole coned in the skin plate, which is to be 1¼ inch thick. In this way, with the aid of a plug screwed inside the coned end, he hopes to form a secure fastening, and prevent the end of the bolt being broken off by concussion. There certainly is something in this conception, but the mode of application proposed by the inventor is impracticable, because no provision is made for drawing the armour plates to their bearings; and the absence of any such provision will cause an amount of vibration which must destroy the fastening. The annexed diagram, Fig. 19, will render Mr. Gray's plan more intelligible.

Fig. 19.

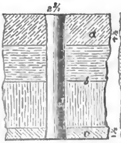
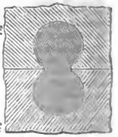


Fig. 20.



Captain Bedford Pim, R. N., has invented a mode of fastening armour plates, which is well deserving of attention. He, with every unprejudiced person who has no wish to bolster up the Warrior system, is a decided enemy to through bolts, and tongueing, and grooving, and he proposes as a substitute for both a double-shafted rivet, inserted between the edges of the plates, which he considers will firmly connect the plates, and form a perfect joint, "nearly water-tight, without any caulk-" ing whatever." Fig, 20 is a front view of the rivet. The edges of the plates being placed together, holes are drilled through the opposite plates in the shape of the rivet, which, when the plates are in position on the ship's side, is driven home, the narrow part of the rivet crossing the joint. By lengthening it to any required extent, the inventor says "it can " be used with equal effect in attaching the " plates to the ship's side, and also can be " driven through the teak backing and firmly " keyed against it." To effect these objects, the end of the lengthened shank of the rivet is to be rounded and wormed for the reception of a nut, so that being brought through the skin of the ship, it would be firmly screwed up to the ribs, and "perform a threefold duty—1st, " join the edges of the plates; 2nd, bring the " plate and backing in the closest contact; " 3rd, make the entire fabric a complete struc-" ture; a very different affair from the present " disjointed and cumbersome mass of wood " and iron called an armour-plated ship." Captain Pim gives details, showing there are no difficulties of construction or expense. Sections and drawings of the rivet, and a specimen of its joining power on 4-inch iron, are at the Institution of Civil Engineers, Great George Street, Westminster.

Whatever may be the merits of the double-shafted rivet—which I have no desire to controvert—it has the fatal characteristics of an outside fastening and a through bolt at the edge of the plates. In its action it is analogous to Mr. Cooper's edge screw bolts, Figs. 14 and 15, and would be exposed to similar casualties, if the impact of shot on a plate evolved its tendency to buckle, of which, I believe, the irresistible effect would be to crack the rivet in two at the neck, and fracture the plates between the two shafts, by breaking away the narrow angles of iron by which the rivet holds on. The result would be complete separation of the plate from its fastenings.

Before closing this letter, Mr. Robert Bowden's system of armour-plating, described in your last publication, demands some notice. As to the "cone-shaped" or "angular-grooved" projections from the body of the plates, he seems not to be aware that Mr. Westwood, the shipbuilder, two years ago, patented a similar plan, which was tested on a target submitted to the fire of artillery. The result was that the projections were broken off in large fragments at every discharge, and the plates were knocked to pieces. Experiment has proved that a plain smooth surface is best calculated to repel projectiles. With reference to Mr. Bowden's mode of fastening, he evidently has paid no attention to the immense difference in the properties of the two materials he has connected with each other, or he never would have thought of hanging heavy masses of iron on to wood, without any other support. The holding force on which the fastenings of his plates entirely depends, is the cohesion and strength of 2 to 3 inches in thickness of wood between the Keys, which are let into mortices in the timbers, and the back of the plates. If this thin strip of wood break away, the plates must be detached from the ship. There is nothing else for them on which to hold on. The iron tongues moreover which project from the back of the plates and are let in between the timbers, are so disposed that receiving the concussion of shot they would split the timbers asunder. There being no backing but wood, the impact of shot on a plate would crush the part struck into the wood, and cause one or both ends to buckle. The inevitable effect would be to tear away the two or three inches of wood interposed between the keys and the plates, ripping up the timbers, and two or three heavy shot striking the same plate would strip it bodily off from the side of the ship. As a backing wood is bad enough, but as a support and holdfast to plates of iron battered by 68-pounders, it is of no more effect than packthread as a ship's cable. A comparison of the tensile strength of wood and iron gives three inches of wood as equal to a quarter of an inch of iron, and wood from its structure cleaves readily in the direction of the fibre.

Once for all, it must be understood that any observations made on plans brought under my notice are founded on the results of experiments, and are sincere convictions. If they can be refuted by arguments based on facts, any mistake will be readily acknowledged.

My next letter will be devoted to the backing of armour plates.

A Civilian.

OBSERVATIONS ON ATMOSPHERIC ELECTRICITY.[*]

I find, says Prof. Thompson, that atmospheric electricity is generally negative within doors, and almost always sensible to my divided ring reflecting electrometer. I use a spirit lamp, on an insulated stand a few feet from walls, floor, or ceiling of my lecture room, and connect it by a fine wire with the insulated half ring of the electrometer. A decided negative effect is generally found, which shows a potential to be produced in the conductors connected with the flame, negative relatively to the earth by a difference amounting to several times the difference of potentials (or electro motive force) between two wires of one metal connected with the two plates of a single element of Daniell's. I have tested that the spirit lamp gives no *idio-electric* effect amounting to so much as the effect of a single cell. The electric effect observed is therefore not due to thermal or chemical action in the flame. It cannot be due to contact electrifications of metallic or other bodies in conductive communication with the walls, floor, or ceiling, because the potentials of such must always fall short of the difference of potentials produced by a single cell. I have taken care to distinguish the observed natural effect from anything that can be produced by electrical operations for lecture or laboratory purposes. Thus I observe generally in the morning before any electrical operations have been performed, and find ordinarily results quite similar to those observed on the Monday mornings when the electrical machine has not been turned since the previous Friday. The effect, when there has been no artificial disturbance, has *always been found negative, except two or three times*, since the middle of November; but trustworthy observations have not been made on more than a quarter of the number of days.

A few turns of the electrical machine, with a spirit lamp on its prime conductor, or a slightly charged Leyden phial, with its inside coating positive put in connection with an insulated spirit lamp, is enough to reverse the common negative indication. Another very striking way in which this may be done is to put a *negatively charged Leyden phial* below an uninsulated flame (a common gas burner, for instance). The flame, becoming positively electrified by induction, keeps throwing off, by the dynamic power of its burning, portions of its own gaseous matter, and does not allow them to be electrically attracted down to the Leyden phial, but forces them to rise. These, on cooling, become like common air, excellent non-conductors,[*] and, mixing with the air of the room, give a preponderence of positive influence to the testing insulated flame (that is to say, render the air potential positive at the place occupied by this flame).

Half an hour, or often much more, elapses after such an operation, before the natural negatively electrified air becomes again paramount in its influence on the testing flame.

That either positive or negative electricity may be carried even through narrow passages, by air, I have tested by turning an electric machine, with a spirit lamp on its prime conductor, for a short time in a room separated from the lecture room by an oblique passage about two yards long, and then stopping the machine and extinguishing the lamp, so as to send a limited quantity of positive electricity into the air of that room. When the lecture room window was kept open, and the door leading to the adjoining room shut, the testing spirit lamp showed the natural negative. When the window was closed, and a small chink (an inch or less wide) opened of the door, the indication quickly became positive. If the door was then shut, and the window again opened, the natural effect was slowly recovered. A current of air, to feed the lecture room fire, was found entering by either door or window when the other was shut. This alternate positive and negative electric ventilation may be repeated many times without renewing the positive electricity of the adjoining room by turning the machine afresh.

The out of doors air potential, as tested by a portable electrometer in an open place, or even by a water dropping nozzle outside, two or three feet from the walls of the lecture room, was generally on these occasions positive, and the earth's surface itself, therefore, of course, negative;—the common fair weather condition, which I am forced to conclude is due to a paramount influence of positive electricity in higher regions of the air, notwithstanding the negative electricity of the air in the lower stratum near the earth' surface.

On the two or three occasions when the indoor atmospheric electricity was found positive, and therefore, the surface of the floor, walls, and ceiling negative, the potential outside was certainly positive, and the earth's surface out of doors negative, as usual in fair weather.

ON A DEW-BOW SEEN ON THE SURFACE OF MUD.

Professor Rankine, in a letter to the *Philosophical Magazine*, says:—

"There was seen to-day (February 13, 1862) by myself and some other persons in this neighbourhood, a very beautiful phenomenon, of which the cause is obvious, and of such a nature that one would expect the phenomenon to occur frequently; but I do not remember to have yet seen any instance of it recorded in any scientific publication. I refer to a prismatically-coloured hyperbolic iris, or bow of the first order, exactly resembling that sometimes seen on a field of dewy grass; but in this case it was displayed on the muddy surface of a by-road near Glasgow, and on the less trodden parts of an adjoining turnpike road, throughout a distance of more than a mile. The time was between 12.30 and 1 p.m. Greenwich time; the morning had been hazy, but the mist had cleared away, and the sun was shining brightly.

"The angular dimensions of the iris were obviously the same with those of a rainbow of the first order; its colours were complete, from red to violet, and very bright and distinct, especially where the mud was softest and moistest; where a sheet of water, how thin soever, covered the mud, the iris vanished. No trace of an iris could be seen on the grass, in the sky, or anywhere but on the mud; and on those parts of the turnpike road where the mud had been much disturbed no iris was visible.

"The necessary conclusion from this appearance is, that the surface of the mud must have been thickly covered with globules of pure water, perfectly spherical and not in absolute contact with the mud, although resting on it; but those globules must have been extremely minute, for they were invisible to the closest inspection with the naked eye."

THE PATENT ELECTRIC AND SELF-RECORDING TARGET.

On Friday last, some interesting experiments were made at Wimbledon Scrubs, for the purpose of testing the efficiency of Chevalier's patent electric and self-recording target. The experiments were conducted under the permission of Colonel Lindsay, Colonel Wood, and of the committee of the Associated Scrubs Corps belonging to the West Middlesex, the Queen's (Westminsters), the St. George's, and the Paddington Rifles. Some forty gentlemen were present, among whom were Lord Elcho, M.P., Mr. Evans, M.P., Colonel Wood, Colonel Pugh, Major Ives, Captain Lochnaw, Captain Fenton, Lieutenant Homfray, &c.

Messrs. Hemmings and Co. are the sole manufacturers of the targets, which are made of various sizes. The one which was used on Friday last is six feet by four feet, and has a bull's eye eight inches in diameter, a centre two feet in diameter, and eight "outers." The target is divided into ten separate plates. Behind each plate hangs a ball and a chain, the ball resting against the plate. When a bullet strikes any plate, the ball flies back and the chain completes an electric circuit and sends along the corresponding wire a signal, which is registered on the face of the indicator by the deflection of a needle. The indicator is a model of the target, and with the batteries is placed on a truck, which can take up its position at any distance from the target, provided there is the necessary length of wire. When the needle has registered a shot, it remains deflected until it is, by a very simple arrangement of the machinery, replaced in its previous position by "

copies the register which the needl

---

[*] Read by Prof. Thompson, before the Manchester Philosophical Society, March 4th, 1862.

[*] I find that steam from a kettle boiling briskly on a common fire is an excellent insulator. I allow it to blow for a quarter of an hour or more against an insulated electrified conductor, without discovering that it has any effect on the retention of the charge. The electricity of the steam itself, in such circumstances, as is to be expected from Faraday's investigation, is not considerable. Common air loses nearly all its resisting power at some temperature between that of boiling water and red hot iron, and conducts continuously (not, as I believe, is generally supposed to be the case, by disruption) as glass does, at some temperature below the boiling point, with so great ease as to discharge any common insulated conductor almost completely in a few seconds.

The ten wires joined to the ten sections are all enclosed and insulated in a small cable. It was agreed that the first experiment should be made at 150 yards distance from the target. The firing, which was generally very good, was begun by Captain Fenton, and continued by Ensigns Hawkins, Peel, and other members of the metropolitan corps. The number of shots fired was twenty-eight, and with a single exception they were registered correctly. In this one instance it was known that the ball had struck some part of the target, but the needle made no movement. An investigation of the cause of the failure was at once instituted, and it was found to have arisen from the breaking of a wire immediately behind the target. Another experiment was afterwards made at 400 yards distance, and this time with entire success. The official report of the experiments therefore was that out of fifty-six shots there had only been one failure. The wires through which the registering was effected were 1,000 yards in length.

Mr. Jenkin, who superintended the experiments on behalf of the manufacturers, explained, in reply to questions from Lord Elcho, that the principle of subdivision could easily be carried further out in the centre of the targets, and when this was done the exact locality of each hit would be more minutely shown. Further experiments are to be made during the next fortnight. It is likely that a meeting will be convened in the metropolis for the purpose of bringing the target into general use among volunteer associations.

Presuming that the applicability of electricity for the proposed purpose is demonstrated to be perfectly reliable, one advantage of using the targets will be that markers, poles, flags, &c., will be unnecessary, and thus a considerable outlay in fitting up ranges for target practice will be avoided.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

March 11th.—John Hawkshaw, Esq., President, in the chair.

"The Paper read was, "Description of the Delta of the Danube, and of the works, recently executed, at the Sulina Mouth," by Mr. C. A. Hartley, Assoc. Inst., C.E.

In the autumn of 1856, by virtue of the treaty of Paris, the European Commission of the Danube, consisting of representatives from each of the seven contracting powers, was charged to execute the works necessary below Isakcha, to clear the mouths of the river, as well as the adjacent parts of the sea, of the impediments which obstructed navigation. This Commission, to which the author had acted as Chief Engineer, was authorised to levy rates, to cover the expense of such works, on the express condition, that the flags of all nations should be on a footing of perfect equality.

In the preliminary studies of the three principal branches and mouths of the Danube, advantage was taken of the charts made by Captain Spratt, R.N., C.B.,; and aided by these, and by the author's own surveys and personal investigations, a brief description was given of the chief characteristics of the progress of the river through its delta. The Danube, after a course of 1,700 miles, during which it received more than four hundred tributaries, and drained upwards of 300,000 square miles, passed in a single channel, 1,700 feet wide and 50 feet deep, the Bulgarian town of Isakcha, situated on the right bank, at 30 and 40 English miles respectively below the large corn exporting ports of Galatz and Ibraila. Isakcha was 76, 78, and 90 miles from the sea, following the courses of the Kilia, the Sulina, and the St. George branches, and 58 miles in a straight line. The head of the delta was reached, at Ismail Chatal, or Fork, 15 miles lower down, and here the fresh waters divided, never to re-unite; seventeen twenty-sevenths of their volume passing in an easterly direction by the Kilia branch, and the remaining ten twenty-sevenths in a south-easterly direction by the Toultcha branch. At 11 miles below Ismail Chatal, this latter branch separated into two channels, the St. George and the Sulina, discharging respectively eight twenty-sevenths and two twenty-sevenths of the whole volume of the main river.

A short account was then given of the three channels, from which it appeared, that the waters of the Kilia were delivered to the sea by twelve distinct mouths, only navigable for fishing vessels; that the river portion of the St. George offered no real obstacles, having an average width of 1,200 feet, and a minimum depth of navigable channel of 16 feet, at seasons of extreme low water; and that in the upper reaches of the Sulina, disaster of every kind was imminent, from the many intricate windings and numerous shoals—the navigable width being rarely more than 300 feet, and the depth over the shallows, during seasons of low water, varying from 10 to 14 feet.

The delta proper was described as being bounded on the north by the Kilia branch, on the south by the Toultcha and St. George branches, and on the east by the Black Sea; the enclosed space comprising an area of 1,000 square miles, and forming a triangle, of which the Ismail Chatal was the western apex, and the sea coast, from the mouths of the St. George to those of the Kilia, the base. During extraordinary high floods, the delta, being unprovided with artificial banks to contain the swollen waters, was almost entirely submerged; whilst at seasons of drought, its banks were elevated from 10 to 12 feet above the level of the river at the Upper Chatal, and from 8 to 10 feet at the Chatal of St. George. In the lower reaches of the three branches, the level of the river was but little affected by variations in the upland waters. Adjacent to the mouths, it never varied more than 1 foot, except when influenced by the wind. During high floods, the inclination of the surface water of the Sulina branch was 3 inches per mile, whilst during extreme low water, it did not exceed 1 inch per mile. At times of ordinary high water, when the current had attained a velocity of from 2½ to 3 miles an hour, the Danube, before it divided at Ismail Chatal, delivered a volume of water equal to nineteen and a-half millions cubic feet per minute; while in the dry season, when the current was reduced to 1 mile per hour, the flow did not exceed seven and a-half millions cubic feet per minute. At times of extraordinary floods, such as that which occurred in March, 1861, the velocity was increased to 5 miles per hour, and the volume of water then delivered amounted to sixty millions cubic feet per minute, or eight times the quantity discharged at ordinary low water. It was stated, as the result of careful observations, that when the waters were most surcharged, they carried to sea at the rate of 1 cubic inch of sedimentary matter, supposing it to be solidified into coherent earth, per cubic foot of water, and that not more than one-fortieth part of this proportion was transported when the floods had subsided. Thus, at the former period, upwards of 600,000 cubic yards of diluvial detritus passed into the sea by the several mouths of the river in twenty-four hours, and at the latter not more than 15,000 cubic yards. The results of these investigations accounted, in a great degree, for the changes which took place, from time to time, in the position and extent of the sand banks forming the bars across the several mouths. At times of high floods, these bars were further from the shore, their magnitude was considerably increased, and the depth over them was diminished; their distance from the shore, and their height, being much influenced by the direction of the prevailing winds. The depth of the sea opposite the delta decreased to the north; thus, at 3 miles from the land, the depth was 16 fathoms opposite the St. George's mouth, and only 10 fathoms opposite the Sulina and Kilia mouths.

During the interval from 1830 to 1857, the shallows of the Kilia advanced fully one mile in the direction of the Sulina mouth. This, combined with the uncertain and changeable nature of the many branches issuing from the Wilkov basin to the sea, and the distance of the bars from the shore, were the chief considerations which induced the author to form an unfavourable opinion of the Kilia—in spite of its possessing the best river channel—and to recommend, in preference, the improvement either of the St. George or of the Sulina, where the sea depths were greater, and the advance of the sand-banks was less remarkable. In comparing the merits of the two latter branches, the author arrived at the conclusion, that in nearly every respect, the St. George offered decided advantages over the Sulina. It was true, that in order to reach the Kedrilles bar of the St. George, double the length of works would be necessary; but when once the sand-banks were passed, the greater sea depths opposite the St. George would insure, for a longer period, a constant good navigable depth at the sea entrance. The St. George's mouth was situated at the most salient angle of the delta, was nearer to the Bosphorus, by 18 nautical miles, than the Sulina, and was more favourably placed with regard to the safe manœuvring of vessels during N.N.E. winds.

Although there was a great difference of opinion as to the merits of each of the three principal branches or mouths, all the technical authorities, who had studied the question on the ground, agreed in recommending that, whichever mouth was chosen, the system of improvement should be that of guiding the river water across the bar, by means of piers projected from the most advanced dry angles of the mouth; so as to concentrate the strength of the river current on the bottom of the proposed improved channel, by an artificial prolongation of the river banks into deep water. After considerable discussion, the commission resolved to improve the bar channel of the Sulina, by guiding piers of a temporary character, in order to give the speediest relief to the navigation in the cheapest manner; but it was distinctly guaranteed, that this should not prejudice the choice of the mouth to be selected for permanent treatment. The author then received instructions to provide works which, for the expenditure of a sum limited to £80,000, should have the effect of giving an increased depth of at least 2 feet, over a period of from six to eight years. This duration of time was based on the assumption that, during such an interval, either the St. George would be opened, or it might be considered expedient to limit the improvement of the Danube to rendering permanent the provisional works.

The designs for the provisional works were then matured; and as it was found, in practice, that the cost of strong timber cribs, to be loaded with stone, and sunk at intervals of 20 feet along the line of the works, would exceed the original estimate, choice was finally made of a structure composed of timber piling and *pierre perdue* surmounted by a timber platform 14 feet wide, strengthened occasionally by solidly constructed cribs of the same width. The works were commenced on the 21st April, 1858, a temporary staging, fixed on piles, being always run out from 200 to 300 feet in advance of the permanent piling. This staging supported nine crab engines, by which three throws of three piles, each 13 inches square, and 7 feet apart, were frequently driven, in one day, to a depth of 16 feet into the hard fine sand of which the bottom was composed. The piles were then immediately secured by double longitudinal walings and double cross-ties, the whole being surmounted by two thick trampieces and planking, at four feet above the level of the sea. From this permanent platform, the close piling on the side next to the sea was driven. The daily rate of progress, during fine weather, was 20 lineal feet; and as soon as this length of sheet piles was completed, stones were thrown down to protect the footing in the sand, which was liable to be washed away by the action of the sea. This scouring action of the sea was so serious, when the skirt of the bar was reached, that it threatened at one time to demand, for the completion of the works, double the quantity of stone originally estimated. Several plans were tried to reduce its pernicious effects. That eventually adopted, and which was perfectly successful, was to advance the open pile work with all possible expedition, and then to pave the proposed seat of the pier with stones delivered from barges. This pavement withstood the attacks of the sea, and offered no great obstruction to the penetration of the sheet piles, which, without being shod, had frequently been driven 10 feet into the ground, after having been forced through 8 feet of rubble stone. The section of the finished stone work was described as being a solid mass of closely packed third-class rubble, resting on a broad base, and narrowing upwards at slopes varying from 2 to 1, near the pier heads, to 1 to 1 and 1½ to 1 near the shore, until slightly below the level of the water, it became a mere ridge against the close piling. The time occupied in the actual construction of the piers was thirty-one months, exclusive of three winter months each year, during which the Danube was frozen over, and all work was suspended, but inclusive of two hundred and seven days when it was impossible to work, on account of stormy weather. The length of the north pier was 4,631 feet, that of the south pier was 3,000 feet, and the depth of water in which they were built varied from 6 to 20 feet. In their construction 200,000 tons of stone and 12,500 piles had been employed, and the cost had not exceeded ten guineas per lineal foot. The stone was brought from a distance of 60 miles, and its price delivered in place, varied from four to five shillings per ton; the oak, used for the longitudinal and transverse timbers and for the planking and fender piles, cost two shillings and threepence per cubic foot, while the fir timber piles were delivered ready for driving for fourpence per cubic foot. The workmen, of whom there were generally three hundred, were composed of men belonging to more than ten different nations. Labourers were paid two shillings and sixpence and carpenters four shillings and sixpence per day.

The changes which had taken place at the Sulina mouth, consequent on the projection of the piers, were then noticed. The depth on the bar, since the year 1829, had varied between the extremes of 7 and 12 feet, the least depth occurring during the subsidence of high-water floods, and the greatest when the deposits lodged by those floods had been dispersed by autumnal and winter gales. In April 1858, when the works were commenced, there was a navigable chonnel only 9 feet deep over the centre of the long shoal forming the Sulina bar. In November, 1859, when the works had been brought to a close for the winter, the north pier had advanced 3,000 feet and the south pier 500 feet, and then the depth on the bar was 10 feet, which was increased to 14 feet by the following April, although the works had remained stationary. Hopes were consequently entertained, that the action of the north pier would, in itself, be sufficient to maintain an improvement; but these expectations were disappointed, as in August, when the north pier had reached a length of 4,600 feet, the depth on the bar had diminished to 9½ feet. Every exertion was then made to bring the opposite pier into play. Accordingly, during the next three months, the south pier was advanced 1,500 feet, and as it was now within 600 feet of the north pier, the good effect of concentrating the whole force of the river current directly on the bar became at once apparent. Thus on the 30th of November, 1860, there was a navigable channel of 12 feet, and on the 28th February, 1861, of 16 feet. Then came the breaking up of the ice in the river, and the furious descent of the extraordinary high floods, which caused so much damage at Galatz, and submerged the whole delta; but this time, instead of the depth on the bar being diminished, the swollen waters confined between the two piers and directed in a proper line, fairly swept away the remains of the bar on to the south bank and into deep water. From that time to the present, the depth had never been less than 16½ feet, and frequently it was as much as 17½ feet, over a navigable width o 500 feet. This result had been accomplished byf works the cost of which had not exceeded the sum that had been paid in one year only for lightening vessels over the bar; and without taking into account the excellent shelter which had been afforded, and the great risks which vessels formerly ran of being wrecked off the entrance.

In conclusion, the author expressed his gratitude to the members of the European Commission of the Danube, for the generous support he had always received; and especially to Major Stokes, R.E., the representative of Great Britain, whose enlightened policy, if allowed to prevail, could not fail, eventually, to insure to the commerce of all nations, the best possible means of water communication with the rich corn-growing countries bordering the shores of the Lower Danube.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, March 13.—Mr. F. Campin, president, in the chair. "On Building Stones," by James B. Walton, V.P.

The author commenced by observing that he had experienced considerable difficulty in determining upon the manner of treating this subject, as various methods presented themselves to his consideration, each of which was deserving of much attention. He resolved, after careful thought, to discuss it geologically, dividing it into two parts, viz., stratified and unstratified, or in other words, aqueous and igneous.

He first directed attention to the former of these divisions, which was arranged in three classes of arenaceous, argillaceous, and calcareous rocks.

Arenaceous or siliceous rocks are generally composed of grains of sands, which are rounded as if by the action of running water, and bound together by some calcareous or siliceous cement. These rocks, which are termed sandstones, are frequently found in one instance where the grains of sand are extremely coarse, or in another where they are delicately fine, this coarseness or fineness is however of trifling importance in comparison with the nature of the materials by which the particles are cemented. Many sandstones have their parts so loosely united as to be totally unfit for building purposes, this being the nature of the rock which underlies the town and castle of Nottingham. Purely siliceous sandstones are admirably adapted to withstand the influences of wind and weather, but where there is an admixture of silex with other materials, great skill is required to select a durable building stone.

Argillaceous rocks scarcely admit of a general description, but most of them emit a peculiar earthy odour when breathed upon, and consist of silica and alumina, with small proportions of lime and magnesia.

Cretaceous rocks, or limestones, are composed of lime and carbonic acid. Many of these stones consist of fragments of shells and corals, which are united by means of a calcareous cement. Those belonging to the oolitic groups are found to consist of small egg-like grains, each of which has a particle of sand for a nucleus, around which are congregated concentric layers of calcareous matter.

Limestones and sandstones of the same specific gravity are found to exhibit the following relations. As regards the resistance to a compressive force, the sandstone has a superiority over the limestone nearly in the proportion of 3 to 2, the absorbing power of the sandstone is less than that of the limestone, as the former absorbs ·097 of its bulk, while the latter absorbs ·114. The sandstone will be composed of silica, with a small percentage of carbonate of lime, and the limestone will consist chiefly of carbonate of lime with small quantities of silica and magnesia.

The author then reviewed the building materials of the Pliocene, Eocene, and Wealden deposits, describing more particularly the Kentish Rag of the Lower Greensand series and the Sussex and Purbeck marbles of the Wealden formation. The latter were stated to have been much employed in the embellishment of our ecclesiastical edifices in the middle ages.

The oolitic rocks were next described, and full particulars were given of the Portland, Ancaster, Bath, and Ketton limestones. It was remarked, as a singular fact, that with reference to the oolitic rocks, the top beds are invariably the hardest, while the lower are extremely liable to decay. Portland stone was stated to be far superior to the Bath and other stones of this formation, and also to be decidedly the best material to withstand the trying influences of the London atmosphere. The average weight of Portland stone is 135½ lbs. to a cubic foot, its specific gravity 2·145, and its absorbing power 0·208. The analysis of this stone, as given by the commissioners in their report of 1838, is as follows:—

Silica	1·20
Carbonate of lime	95·16
Carbonate of magnesia	1·20
Iron alumina	·50
Water and loss	1·94
	100·00

The analyses of the Ancaster, Bath, and Ketton stones, according to the same eminent authorities, is as follows:—

	Ancaster.	Bath.	Ketton.
Carbonate of lime	93·59	94·52	92·17
Carbonate of magnesia	2·90	2·50	4·10
Iron alumina	·80	1·20	·90
Water and loss	2·71	1·78	2·83
	100·00	100·00	100·00

The oolitic stones of Oxford and Northampton were next referred to, particular notice being directed to the yellowish and rusty appearance of the buildings in those vicinities, and to the lamentable symptoms of decay which many of them exhibit.

The lias and new red sandstone districts were described, and the building materials were dilated upon at some length.

The permian or magnesian limestone series was next introduced, and interesting particulars were given with reference to the selection from these deposits of the material for the construction of the new Houses of Parliament.

It appeared that the Commissioners first recommended the Bolsor quarries, from having observed that the Norman porch of Southwell Minster, which was supposed to have been executed in this stone, was as free from decay as when it was erected 800 years back. These quarries were however abandoned in consequence of the stone being small in bed and difficult to remove from the earth; the Auston beds in Yorkshire, belonging to the Duke of Leeds, situated about five or six miles from Bolsover were then examined, and found to fulfil the requirements of the Commissioners, so this stone was adopted, and delivered in London at the rate of 200,000 cubic feet per annum for several years.

Numbers of buildings have been executed in this material, both in London and the country, and instances were given in which the stonework is already suffering much from decay.

The Analysis of the Auston stone is as follows:—

Carb. of lime	54·89
Carb. of Magnesia	42·07
Protoxide of iron	0·49
Peroxide of iron	0·56
Silica	0·51
Water	0·24

The magnesian limestones of this district were stated to be very numerous, and to vary but slightly in their chemical constituents, that quarried at Mansfield Woodhouse, in Nottinghamshire, was described as being more durable than the Auston stone, but so expensive to work that it is but seldom employed. It was used by Mr. Gilbert Scott in the construction of the Martyrs' Memorial at Oxford, in 1840, and is found to stand remarkably well.

The Cragleith and Bramley Fall sandstones of the carboniferous system were described at some length, and were stated to be admirably adapted to resist a great compressive force, and to withstand the varied influences of weather, wind, and water. The average weight of a cubic foot of Cragleith is 146, and of Bramley Fall 142½lbs. The latter is capable of withstanding a pressure of 100,000 lbs. to a cubic foot, which is nearly the amount safely sustained by Portland. The piers of the railway bridges at Pimlico and Fulham are constructed with this material.

The Devonian, Cambrian, and Silurian systems all furnish excellent materials for building, and were described at some length.

A review was then given of the igneous or unstratified rocks, particular mention being made of granite, syenite, and greenstone. The decay of granite was briefly noticed, and accounts were given of the strength of several varieties of this material, including the Aberdeen, Peterhead, and Cornish granites. The Aberdeen granite is considerably lighter than that quarried in Cornwall, but possesses nearly double the resisting power to a compressive strain.

Particulars were given with reference to the expansion of stones, and an account of some experiments recorded in the transactions of the Royal Society of Edinburgh was related, from which it appeared that the building stones in common use expanded nearly in the same proportion as cast iron.

The author concluded his paper with some observations on the decay of stone, and made especial reference to the decomposition of the materials employed in the construction of the Houses of Parliament. An analysis of the evidence taken before the committee appointed to inquire into the decay was given. It appeared from the evidence of Mr. C. H. Smith, one of the commissioners of 1838, that the stone was all taken indiscriminately from the quarry, and that the selection was left to persons who had little knowledge of the subject. The decay was stated to be most apparent in all damp and sheltered situations, the stone being in good preservation in many places where it was exposed to the full action of wind and weather. The various means adopted for the prevention of the decay were described, particular reference being made to those of Messrs. Szerelmey, Ransome, and Dames. An extract from the report of the committee was given to show that the true solution of the difficulty is not yet arrived at, as none of the methods employed were attended with much success.

An interesting discussion followed the reading of the paper, in which Messrs. Chubb, Roberts, Rutt, Patterson, Newland, Varicas, the President, and the author took part.

MEETINGS FOR THE WEEK.

Mon.—*Royal Geographical Soc.*, I. "On the Exploring Expedition to the Western Borders of China, and the Upper Waters of the Yang-tse-kiang," by Dr. A. Barton. II. "Notes on the Country to the west of Canton," by Lieut. Oliver, R.A., at 8.30 p.m.

London Inst., "On the Instrumental Music of the Opera," by Josiah Pittman, Esq., at 7 p.m.

Medical Soc., Clinical Discussion at 8.30 p.m.

Tues.—*Inst. Civil Engineers*, "Description of Works at the ports of Swansea, Silloth, and Blyth, Part II." by J. Abernethy, Esq., at 8 p.m.

Royal Inst., "On the Physiology of the Senses," by J. Marshall, Esq., at 3 p.m.

Zoological Soc., at 9 p.m.

Wed.—*Society of Arts*, "On the Commerce of our Colonies, and their Cost," by Henry Ashworth, Esq., at 8 p.m.

London Inst., "On the Seven Metals of the Ancients," by F. Field, Esq., at 7 p.m.

Soc. for the Encouragement of the Fine Arts, Second conversazione of the Season, at 8 p.m.

Thur.—*Royal Inst.*, "On Heat," by Professor Tyndall, at 3 p.m.

Antiquaries, at 8.30 p.m.

Civil and Mechanical Engineers, "On Retaining Walls," by Mr. William Rutt, at 7.30 p.m.

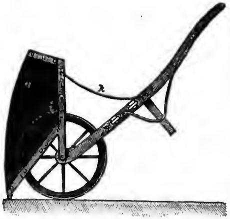
Fri.—*United Service Inst.*, "The Causes of Sickness amongst British Soldiers during Campaigns, and the best means of Preventing this Sickness," by Dr. Parkes, F.R.S., at 3 p.m.

Royal Inst., "An Explanation of the Meteorological Electric Telegraphy, and its basis, now under trial at the Board of Trade," by Admiral Fitzroy, F.R.S., at 8 p.m.

London Inst., "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.

Sat.—*Royal Inst.*, "On Spectrum Analyses," by Prof. H. E. Roscoe, at 3 p.m.

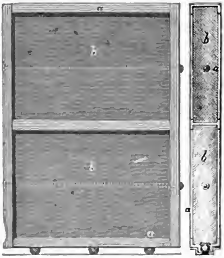
REY'S IMPROVED WHEELBARROW.



The above engraving illustrates a wheelbarrow of a very novel and useful form, the invention of M. J. Rey, of Tournon, France.

a is the shell or case for holding the materials; it is attached to arms, levers, or eccentrics, having holes or bearings, working on spindles, fixed to the shafts or side frames *d*, which are maintained at the proper distance apart by one or more cross pieces. When it is necessary to empty the contents of the case, the handles are raised until the forward weight tilts the case completely over. For the purpose of drawing or jerking back the shell or case after it has been emptied there is a chain, cord, or strap *k*, fixed to each shaft *d* and to each side of the shell.

HOGG'S FIRE-PROOF DOORS AND SHUTTERS.



These improvements in the construction of doors, gates, and shutters, just patented by Mr. W. Hogg, of Rotherhithe, Surrey, consist in forming them of parallel iron or other metal bars *a* rebated or grooved to receive bricks *b* or other moulded forms of earthen materials. The parallel iron bars are combined with an external iron framing of the form and size desired. If the bricks are to be placed edge to edge the grooves of the iron bars are adapted to receive the ends of bricks in the narrowest direction, the bars being disposed at distances apart equal to the length of the bricks; the bricks are slid into place and in close contact between each two adjoining bars, and may be further cemented together while the extreme bars forming the external framing, say at top and bottom, need be grooved only on one side, while the vertical side bars need not necessarily be grooved at all. The bricks may in like manner be disposed with the sides in contact, in which case, the door or other structure, will be thicker and the bricks may even be placed with their length in the direction of the thickness of the door; for such thick structures, it is preferred to use larger bricks or moulded forms for the purpose; for lighter structures moulded earthenware articles smaller than bricks may be used. These doors are mounted on hinges or on rollers so as to slide or otherwise as may be most suitable.

BENNETT'S METHOD OF TINNING LEAD PIPES.

FIG. 1.

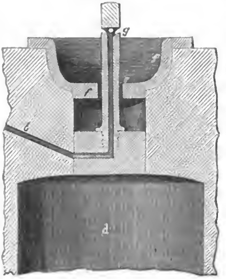


FIG. 2.

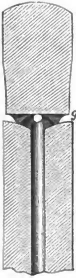


FIG. 4.

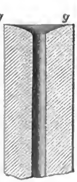
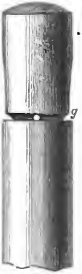


FIG. 3.



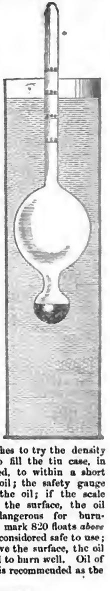
This invention, patented by Mr. F. Bennett, of Bagillt, Flintshire, relates to those lead or lead composition pipes, which are manufactured by hydraulic pressure, and consists in forming the core or mandril, over or round which the pipes are formed hollow or tubular, and in causing the tube or hollow in the machine to communicate with a reservoir or supply of tin, or alloy of tin, the level of which is maintained at such a point that the tin will just overflow the lip or upper end of the tubular mandril. The thickness of the coating is regulated on the inner surface of the lead pipe by pressure. As the leaden tube is formed over the hollow core or mandril so it receives on the interior a uniform coating of the tin or tin alloy, which is kept flowing over the lip of the mandril.

Fig. 1 of the above engravings is a vertical section of so much of a hydraulic press as is necessary to illustrate this invention; *b*, is a passage by which liquid tin, or tin alloy, is led from a spout to the hollow mandril; *d*, is the lead, or lead composition reservoir; *e*, is an annular space between the hollow mandril, and the die *f*. Upon the hydraulic press being set in motion, lead is forced up between the die, *f*, and the mandril in the ordinary manner; when the pipe reaches the lip, *g*, liquid tin is spread over its internal surface and the coated pipe passes on to the solid portion of the mandril, the lead and tin become consolidated, and the finished pipe is carried away in the ordinary manner. Fig. 2 is a section, and Fig. 3 an elevation on an enlarged scale of a portion of the mandril in which the tin, or tin alloy flows over the lip, *g*; and Fig. 4 is a section of a mandril in which tin, or tin alloy flows over the upper end.

THE PARAFFINE OR MINERAL OIL SAFETY GAUGE.

The public have been recently alarmed at the frequent accidents occasioned by paraffine oil explosions. These explosions are said to be attributable to the quantity of *light* explosive spirit existing in mineral oils at about 800°. Large quantities of oils have been introduced into this country from the continent and America, which are for the most part of a light gravity. The English manufacturers, adopting a higher standard, make their oils considerably heavier, consequently they do not contain those explosive and dangerous elements which characterise the lighter oils. We are informed that no explosion has been traced to oils of a density of 820° and upwards.

The Asphaltum Company, of 34 Great Winchester-street, E.C., have provided a safety gauge, whereby the density, and consequently the explosive qualities, of paraffine oils may be tested. It consists of a glass tube, as represented in the accompanying engraving, the bottom bulb of which is partly filled with quicksilver, and the neck of the tube is marked with the figures 820, 830, 840, and 850.



Any one who possesses the safety gauge, and wishes to try the density of any oil, has merely to fill the tin case, in which the tube is supplied, to within a short distance of the top with oil; the safety gauge must then be floated in the oil; if the scale mark 820 sinks *beneath* the surface, the oil should be rejected as dangerous for burning purposes; if the scale mark 820 floats *above* the surface, the oil may be considered safe to use; if the 850 mark floats above the surface, the oil generally will not be found to burn well. Oil of the specific gravity of 830 is recommended as the best and most useful.

In compliance with a wish expressed by one of the members of the committee of the Albert memorial, the council of the Institute of British Architects will be happy to receive information as to the quarries in this country best adapted for detaching a block of granite or other suitable material for an obelisk, not less than 100 feet in length by about 8 feet square; also, as to the expense of conveying the completed shaft by land or water to London, and any other information or suggestion of a practical nature.

AMOS AND FRANCIS' SLATE DRESSING MACHINE.

FIG. 1.

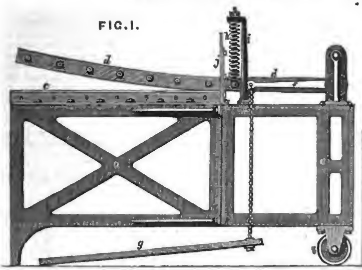
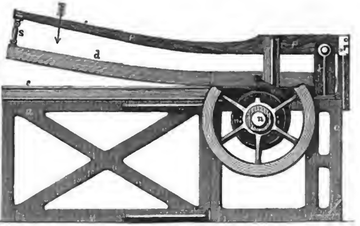


FIG. 2.



AMOS AND FRANCIS' SLATE DRESSING MACHINE.

Mr. C. E. Amos, of the Grove, Southwark, has in conjunction with Mr. J. Francis, of the Penrhynn Slate Quarries, Bangor, obtained a patent for an improved machine for dressing slate for roofing purposes.

The machine consists of a rectangular frame, which may, if necessary, be mounted on wheels for the convenience of transporting or removing the machine from one locality to another. This frame is provided with a fixed knife, and also suitable bearings for a lever or "sword arm," which carries a moveable knife. The "sword arm" or "lever" is suspended by a spring, so that when in a normal position the moveable cutting edge is raised above the lower knife edge, and the two edges resemble a pair of open "shears," and act in the same manner. A treadle frame is attached by means of a link to a lever, which is upon the same spindle as the "sword arm," and the knife edges are brought together by the pressure of the foot of the workman; or, if desired, the machine may be worked by mechanical power by applying power to the treadle lever, or the treadle lever may be dispensed with, and the power may be applied direct to the "sword arm." The spindle of the sword arm is made adjustable, to compensate for wear in the cutting edge and other working parts, and a gauge plate with suitable marks or points corresponding to the different recognised sizes of roofing slates is placed on the framework, so that the rough slates may be laid in their proper places and adjusted with facility. If desired, a double set of shears or cutting edges may be employed, so that two sides of the slate may be cut, trimmed, or dressed at the same time, but this will not be found a convenient arrangement in practice.

In the accompanying engravings, Fig. 1 is a side elevation of a slate dressing machine, to be operated by the foot of the workman.

a a is the framework of the machine, which is supported at one end on wheels or rollers *b b*, for the convenience of transporting the machine from place to place; *c* is a fixed cutting edge, made of steel or other hard metal, and secured to a cast-iron cheek or back plate, which is fixed on the top framing of the machine by screw bolts and nuts, so that it may be adjusted at pleasure; *d* is a knife, or moveable steel cutter or shear, secured by bolts or screws to the vibrating sword arm, which is mounted at its inner end on the horizontal shaft *e*. A horizontal lever or arm *f* is also mounted on the shaft *e*, and is provided at its outer end with an eye, into which is hooked a rod, rope, or chain, whereby the lever or arm *f* is connected with the treadle or foot lever *g* below. In order to support the sword arm and moveable cutting edge in an elevated position, as shown (so as to be ready to operate upon a slate when it is brought up to the shears), a coiled spring *h* is attached by one end to the arm, and by the other is suspended from the upper end of a bracket *i*, which is fixed on the top of the framing; a vertical gauge plate *j* is secured in a proper position on the framing by screw bolts or otherwise, and it must be so adjusted as to be exactly at right angles to the shears. The operation of the machine is as follows:—The workman takes in his hand a slate that requires to be dressed, and having presented one edge to the shears he places his foot on the treadle *g*, and brings down the lever *f* and sword arm *d*, and thus cuts and dresses one side of the slate. The dressed side is then placed against the vertical gauge plate *j*, and a fresh undressed side is presented to the shears, which by the workmen depressing the treadle *g* are made to trim this side also. The third and fourth sides of the slate are presented to the shears in like manner and are properly trimmed, their edges being cut at right angles to each other and to the proper size, which is done by bringing up the slate to certain marks on the gauge plate *j*. The stationary cutting edge *c* is adjusted vertically, to compensate for wear; and in order to adjust the cutting edge of the upper or moveable blade *d* the bearings of the shaft *e* are made adjustable. The ends of this shaft are supported in the blocks *k k*, which rest on thin pieces of wood, metal, cardboard, or other substance, and by altering the position or thickness of this packing the shaft *e* may be raised or lowered bodily, as may be required.

Fig. 2 is a side elevation, of a modification of the one just described. In this instance the treadle is dispensed with, and the moveable cutting shear is operated through the intervention of a cam *m* on the main driving shaft *n*, which is driven by a band passed round pullies *a*, and at one end carries a fly wheel. Instead of employing a spring to support the sword arm *d*, and keep it elevated when in a quiescent state, a strong wooden spring or sword *p* is secured in standards *r*, *r*, above the sword arm *d*, to which it is connected at its outer end by a jointed link *s*; and the tendency of this spring is to force down the arm in the direction of the arrow. The normal or quiescent state of the shears in this arrangement of the cutting edges is therefore to be closed or shut like a pair of scissors, and in order to open them for the purpose of inserting the rough side of a slate to be trimmed, the driving shaft *n* must be set in motion, and the cam *m* by bearing against and lifting a pin fixed in one side of the sword arm *d*, will raise the same and open the shears, so as to admit of a slate being placed between the cutting edges; but immediately the highest point of the cam passes from under the pin the arm *d* will be forced down by the elasticity and power of the wooden spring sword *p*, and will cut or trim the edge of the slate. It will be seen that the axle of the sword arm *d* is mounted in adjustable blocks *k*, *k*, as in the former instance, and the bearings of the main or cam shaft *n* are also adjustable vertically.

Telegraphic Intelligence.

ATLANTIC TELEGRAPH COMPANY.

On Wednesday last, the fifth annual meeting of this Company was held at 22 Old Broad Street, the Hon. Stuart Wortley in the chair. After the Secretary, Mr. Seward, read the report, which wore a hopeful aspect,

The Chairman, in moving the adoption of the report, said they were not in such a state of depression as they were at their last meeting, although they could not show a large cash balance at the bankers; yet, owing to the exertions of the directors, they were free from all liabilities. Recent events had directed attention to the subject of telegraphic communication with America, and there was now a probability of this project being successfully revived, if they could only secure the co-operation of the public and of the Government. Since the failure in 1858, great progress had been made in the practical science of cables, and they could now say, with very great confidence, that a line of this distance could be laid with great success, and with remunerative results. A great many cables had been laid, and it was wonderful that there had been so many successes and so few failures. Messrs. Glass, Elliot, and Co., who had laid nearly all the submarine cables in the world, had prepared an important statement, which stated that they had manufactured and laid down twenty-four cables, all of which were at this moment in working order, with one brief exception, and that exception was a short line on the shores of this country which had been in shallow water. The length of these twenty-four cables in statute miles was 3,407, and the length of insulated wire in miles was 5,702. The last cable laid by them was from the colony of Algiers to Toulon, 600 miles in length, and at a depth of 1,800 fathoms, being only 300 fathoms less than the depth of the Atlantic cable. Ten years ago this would have been thought very dangerous to attempt. The cable was now worked with great success. The utility and great importance of these undertakings had been acknowledged by foreign Governments. France had given the greatest encouragement to them. Spain, and even the Sublime Porte, had given assistance in the promotion of submarine lines. Our own Government had also directed their attention to a line connecting the East, and he could but hope that they would become alive to the importance of communication with America. Mr. Seward, the American Foreign Secretary, in a recent despatch to the American Minister, Mr. Adams, had instructed him to make overtures to our Government, with a view of restoring the communication between the two countries. Mr. Cyrus Field, who was over here as the agent of the American Government, had also been engaged in promoting the line, and proposals had been made to our Government, but up to this moment they had not been agreed to. He might be permitted to state that the proposals made to the Government were to the effect that the Government should grant this company or any other company a moderate guarantee, so as to enable them to get the necessary capital, or to join with America or France in order to make the grant lighter. From what Earl Russell had told him (the chairman) he believed that the refusal of the Government was confined to the present time. It was likely, if public opinion could be brought to bear upon them, that Government might consent to render assistance to their undertaking. It was the duty of the shareholders to support the line, as it would be to their advantage; and if the capital was found he for one was entirely sanguine of success. With respect to rival lines, the essential feature of their line was that it would be a British one. A line had been projected through Denmark and Greenland, but Denmark was a weak nation, and it would never do for their line to be subjected to foreign influences.

Mr. Samuel Gurney, M.P., seconded the motion for the adoption of the report.

OCEAN TELEGRAPHY.

On March 15th a lecture was delivered at the Mechanics' Institute, Plymouth, by J. E. Davis, Esq., R.N., F.R.G.S., on the subject of ocean telegraphy, and particularly in reference to that great problem of the day, "Telegraphic Communication with America;" and as Mr. Davis accompanied Captain Allen Young in the yacht Fox, in 1860, to ascertain the practicability of the northern route, as marine surveyor, his observations are entitled to respect, both with regard to the merits of the two great lines under discussion—the direct, between Ireland and Newfoundland, and the northern, *via* Fœroe, Iceland, Greenland, and Labrador; and also in regard to the nature of the cable best suited for deep-sea telegraphy. Mr. Davis exhibited a number of specimens of cable, also diagrams of the ocean bed on both lines. In the course of his lecture Mr. Davis said that one strange circumstance connected with the Atlantic cable is not generally known, and that is, an American company has obtained from the colonial government at Newfoundland the sole right to establish telegraphs from that island and the adjacent coast of Labrador to the United States, and also the concession to the exclusion of others of landing wires on the coast, so that an English company could not land a cable on the shores of an English colony without the permission of a foreign company. £70,000 was paid for that permission by the English company, with a certain royalty to be paid on every message transmitted. There was also a stipulation as to time, so that if we wished to take another cable across now, another subsidy would have to be paid for permission to land, and that is what brings Mr. Cyrus Field over to this country. He is chairman of the American company that holds the concession, and is naturally anxious to finger another £70,000 of English money. The cause of the failure of the Atlantic cable has been explained, electrically, by Mr. Hearder in his paper read at the Plymouth Institution in Dec., 1858. I will merely point out its mechanical defects. With regard to that cable and cables in general (I am speaking more particularly of those intended for deep sea), here, are several specimens of iron roped ones. They have been constructed as if they were meant to be paid out of a drawing-room window. There is not a sailor's cable amongst them; and here I may remark that I think fewer mistakes would be made if engineers would drop their exclusiveness, and take into their counsels a few scientific sailors. These cables are beautifully constructed, not a fault can be found in the regularity with which the component parts are put together. Their specific gravity is well ascertained; they weigh so much in air and so much in water. But the question is, are they practical both with regard to stowage on board a ship and paying out, also regulating that paying out in a heavy sea: in fact, getting the cable to the ground without injury? I say I believe they are not; and I also believe that the iron wire which is meant to give such enormous strength is only a source of weakness, and not of strength; for a cable can be considered only so strong as it is in the weakest part. Now, this cable is coiled on board a ship in huge coils; consequently, the lowest sheave of the coil is subject to the pressure of the superincumbent weight of the coil, which in itself is enormous. Gutta-percha is compressible, and softens at a low temperature. The heat of the ship's hold, especially if near the influence of the engine-room, all tend to injure that lowest sheave; and I do not believe that the lowest sheave is in the same order or condition when paid out as the upper. Again, the great weight renders them very difficult to regulate in running out without an enormous strain being put on them—a strain that must injure the cable; and in the case of the Atlantic, it having to pass over one wheel and under another of the break, the strain did not come equal on the strands, so that I cannot but believe that with a heavy strain on when the cable left the brake, it was more or less injured; and so it will be with all iron-covered cables; the unequal tension in paying out over wheels of small circumference will weaken them. Strange misapprehensions are entertained by many talented men as to the nature of the bottom, with regard to its acclivities and declivities, and also of abrasion. They say a heavy cable is necessary to take up the inequalities of the bottom as the ship proceeds, for with a light cable a ship might be 10 miles from over the spot when the cable reached the bottom, and it might stretch from one height to another without being able to take the inequality. Now we have nothing to prove that the ocean bed is anything but a gently, very gently, undulating surface, and quite different from the land (a glance at the charts of our own shores to the outer soundings will prove that); and as to abrasion, excepting near to the shore, or in a strait, I have no faith in it at 30 fathoms water and upwards. In 1,000 fathoms water, where a 64lb. ball and a very small line reaches the bottom so gently that were it not timed you would be doubtful when it was down, the heaviest of these cables would reach the bottom like a flake of snow falling on the surface of the earth, and the most delicately-constructed cable possible would be more free from injury in 1,000 fathoms than on the surface of the ground. Such is my opinion, so that (allowing the electrical conditions are perfect) the great desiderata in a deep sea cable is strength, small specific gravity, and small size; in fact we want a "pay me out" cable, and not a "hold me in" one. With such a cable as I have described there would be no difficulty in coiling it on board ship, handling it, paying it out, and checking it if necessary. Let the ship go as fast as it is possible to pay the cable out with safety (with the certain per centage for slack), and then if in deep water it falls on knife edges it will not hurt. The best sailor's cable I have seen (but I must own I have not seen all), is the patent of Mr. Hearder. The conducting wire is coated with gutta percha, or india rubber; then spiral cords of the finest twisted hemp—this is strength in the right place, over the hemp is a glutinous coating, of great use to repair the cable, for if the india rubber insulator were punctured with a pin, or nail, the glutinous coating would repair the damage without destroying the insularity. The hemp is again covered with gutta-percha or india rubber, then completed with the hemp covering, either spirally or plaited. With regard to the selection of a suitable cable, there should be a committee of electricians, and all the different forms of cable submitted to them. Let them decide on those that possess the electrical conditions necessary. Then let a body of scientific sailors decide which is the best for laying; and the telegraphic engineer superintend the whole. One word with regard to the ship to lay the cable. I do not consider a man-of-war suitable for the purpose. A ship should be built for the purpose; everything, both in build and fittings, should be directed to the one purpose. As the cable ran out, compensating weights for the cable paid out should be taken in, to keep the ship in trim. The very discipline of a man-of-war is not conducive to the safety of a cable; the captain is supreme there in spite of engineers and electricians, and a command from him might risk half a million of money. I am of opinion that every one, even to the cabin boy, should have a stake in the safe laying of the cable. Manufacturers, engineers, electricians, and every man that puts his hand to it, should have something to gain or lose by its success or failure. What does a gang of men-of-war's men or mariners care about the cable? All they get is much extra labour, and wear and tear of clothes. Men-of-war, if you please, for scout and pilot ships, but let them not touch the cable, except in case of necessity. After describing the northern route, *via* Fœroe, Iceland, Greenland, and Labrador, Mr. Davis says,—The one great difficulty on this route is from the Greenland coast, on account of the ice and ice-bergs, and the numerous gales to be met with off Cape Farewell, as off all continental capes; and it is to be allowed there are difficulties, and by no means to be considered lightly of, but they are not difficulties that cannot be overcome by the pluck, energy, and perseverance of Englishmen. It must be owned that it will require the best ships, the best men, and above all the best captain, as a director of the whole, to be found. With these and common sense on the part of the directors, shareholders, and the public, in not expecting impossibilities: not to be too sanguine, too impatient, too elated, or too depressed, I have no doubt of its practicability and ultimate success. As to icebergs, I have already proved that the Fiords are deep enough for the cable to lay in safety under the largest seen on the coast. The pack or store ice is a formidable opponent to meet with in the actual laying of the cable, although with proper care and circumspection, I do not apprehend any danger there, as the arrival and departure of the pack ice is generally known, and can be avoided; but I will proceed to lay this portion of the cable, as it is the portion the difficulties of which so much stress has been laid on. We will suppose Julianchaab as decided on as the starting point; depots of coals being established at the various ports down the coast. Our ship, with the cable on board, and two pilot or scout steamers, will proceed in May to the coast, going direct into Julianchaab if they can, or proceeding north, and, taking their time, proceed south inside the ice. Arrived at Julianchaab safe, and all arrangements being complete, one of the pilot steamers will take up her position at Hollander's Island (an island and anchorage near the entrance of the Fiord), they will establish a station on the top of the island. We will take a growing moon; on the signal being made from the hill that no ice is in sight the pilot steamer will start out to an offing of 150 miles, the signal being made at the same time to the cable steamer to prepare, if the sea is clear of ice the pilot steamer signalizes to the hill, on her return, the hill to the cable steamer. Steam being up, she drops the end of the cable and away she goes, gets the desired offing and away for Iceland—six or seven days with a light cable will lay it; the same process repeated will do for the Greenland and Labrador section. The arguments in favour of the Northern route are, that commercially speaking the direct line will never pay; that supposing the expenses are equal, the transmission of messages will be no less than nine times greater by the northern than the direct route: that if there is a flaw or puncture in the direct upwards of 2,000 miles of cable and the whole capital of the company is gone, whereas by the northern only a section in which the fault lay would be lost—an axiom agreed to by all that it is better to lose a part than the whole; but the strongest argument I think is this: A contractor is to be found to guarantee the efficient and satisfactory working of a cable 2,100 miles long, provided (mark the proviso) "that it be laid and maintained in the condition as manufactured by them." That is something like the Dutchman who had 100 reasons for not firing a salute, the first being that he had no powder; the other 99 were dispensed with. Who could prove, with the cable once down, that it was or was not laid in the condition manufactured? Then again an important condition is left out, viz., the rate at which it will work. Now for the northern; contractors are to be found to take the responsibility of laying and working the northern line, and that at a less cost than the direct route; that argument speaks for itself. I have had somewhat to do with the northern route, but I beg to be understood that I have no personal interest whatever, either now or in future, in the success of one line or another, in one cable manufacturer or another, and I am not here to advocate any interests. I have done my best to point out the advantages and disadvantages of both lines, but I am of opinion that if America is to be connected by telegraph with England it will be by the northern route—time will show. If others differ, as doctors will, let them lay another direct line, there is room and work enough for a dozen, but let me advise any intending shareholder of the direct to hedge in with a few of the northern, and keep an account of his returns.

Lord Palmerston, in giving evidence before a Parliamentary Railway Committee last week, stated that he had turned his attention very much lately to the defences of the country, and that it was most important that all the arsenals should be connected by railway, and of similar gauge. His Lordship also stated, that it was in contemplation to make some defences on an island in the British Channel, and that it was advisable that Portsmouth and other arsenals should be connected with Bristol by a railway without break of gauge. Pembroke, his Lordship said, in answer to a question, was not an arsenal; it was simply a building and refitting yard. His Lordship also stated that he was in favour of connecting all towns on the south coast by rail.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

THE GREAT EXHIBITION BUILDING—SOMETHING TO BE SAID ON *BOTH* SIDES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—The Mechanics' Magazine always having been characterized by fairness, I think that, notwithstanding the opinion I am about to offer is different to yours, you will nevertheless allow me to record it in its columns.

I doubt not that people generally are discontented with the Exhibition building, and am persuaded that the dissatisfaction arises from their not considering that the erection is only a temporary one. Were it to be a permanent thing the case would of course be very different, and, as it is, I hold that any attempt at ornamentation would not have been expedient. The expense of *adequate* ornamentation is too great to have warranted its application to only a *temporary* structure, however vast; and therefore what is, is best. You have stated the form of the building to be too square, which, architecturally, is perhaps the case, but then it has the practical advantage of enabling easier transport from place to place, which, in a building of this kind, where it is desirable that everything may be seen with the least trouble, is of great—perhaps the greatest—importance.

Not having seen the interior of the structure I am unable to determine whether or not there is any reason for the apparant confusion you speak of; and as to the sinking of the level, considered with reference to its object, and, notwithstanding their plainness, the two magnificent principal entrances, I say that these things are indications of a man who will not, and properly, be tammelled by architectural rules or names, however customary the one, or high the other. I applaud Captain Fowke, considering his undertaking to be a great success, and would here add, as some may think the contrary, that I have no knowledge of him, and write merely to point out that his work is not so defective as has been supposed and asserted. I do not look upon it as perfect, completely satisfactory; thinking that if the domes were in the centre, the effect, which would be novel, would be superior to that now produced, but at the same time, I claim for him no mean success, protesting against the grumbling which the press has set up upon the matter.

I am, sir, yours, &c.,

J. Alexander Davies.

March 17th, 1862.

"GIGANTIC ENGINEERING PROJECT—A SUSPENSION-BRIDGE IN SOUTHERN ITALY."

Sir,—An article, headed as above, copied from an American paper, appears in your Magazine of yesterday. Permit me to correct one or two errors, which are probably those of the American press. The engineer's name is Alphonse Oudry. The bridge in question is the one alluded to in my letter, headed "Channel Railway Suspension Bridge," which appeared in your paper of the 1st November last.

The steel will not be made by Mr. Krupp, but by W. Butcher, junior, of the Rutland Works, and Messrs. John Brown and Co., of the Atlas Works, Sheffield; a similar bridge of short span, 110 yards, entirely of steel, is now testing at the Corporation Hydraulic Press, Birkenhead. On the rigidity and strength of this bridge depends the great bridge at Messina.

You will oblige me by inserting this letter, as I should (like every Englishman) desire that the public should be informed that it is not necessary to apply to Prussia to make steel. I repeat, the steel tested at Messrs. Brown's, made both by Mr. Butcher and Messrs Brown, stood the tests made in my letter, of fifty and seventy tons, respectively; fifty tons being the tensile strength per square inch of the Bessemer steel of Messrs. Brown, and seventy tons of the steel of Mr. W. Butcher. I rather think Mr. Krupp would find it difficult to beat either.

Yours obediently,

A Civil Engineer.

Katesgrove, Reading, 13 March, 1862.

GREAT WROUGHT IRON SHOT, THE ERICSSON BATTERY.

Sir,—The *Scientific American*, of Feb. 22, says:—"The Ericsson iron-plated floating battery at Green Point has been armed with two 11-inch Columbians, which have been furnished with 400 wrought-iron round shot, each ball costing 47 dollars, and weighing 184 lbs. These balls were made by forging square blocks of iron at the Novelty Works, then turning them in the lathe. The cost of the 400 amounts to 18,800 dollars, and their total weight is 73,600 lbs. Cast-iron shot are liable to break in pieces when fired against thick iron plates. These wrought-iron shot are for smashing through the sides of such ericsson floating batteries as the Merimac, at Norfolk; and Hollin's Turtle at New Orleans.

Compare the above with our doings as reported in the *Times* of the 7th inst. Also compare the following sentences in Lord Bury's very sensible letter in the *Times*, same date, with the conduct of the Select Committee at Woolwich for the last *forty* years to my knowledge and *heavy* cost. "The test proposed is, therefore, no test of rifles, whatever it may be of shooting. The second condition is, no restriction to powder, but the ordinary, not mechanically fitting hardened balls, to be used; now, this is exactly of a piece with what some of the competitors have been doing during the past week at Woolwich. The want to 'bar' science, and to make every one compete on their own level."

I am, yours, &c.,

J. Norton.

Howard's-hotel, Kingstown, Dublin, March 10.

P.S.—The mechanically fitting hardened balls fitting into the grooves of the rifle, are what I used at Woolwich, in the year 1823, according to the recorded evidence of Major-General Sir Richard Airey; and in the same year, at Clontarf, Ireland, according to the recorded evidence of Captain James Whitley, late 9th regiment; and in 1827, according to the recorded evidence of Lord Rosse. My gossamer cartridge having a small portion of gun-cotton at its inner end, cleans out the barrel of the rifle so as to allow the mechanically fitting shot to be rammed down easily.

J. N.

Gossip.

A new product, which bids fair to compete with, if not to supersede turpentine, has recently been obtained. It is distilled from petroleum and asphaltum. The asphaltum company have succeeded in producing this spirit, which can be used in the place of turpentine, without danger or fear. And as it can be obtained at one third of the price cheaper than turpentine, it is likely to be extensively consumed.

Mr. J. A. Davies writes us to say that in No. 9 of the *Engineer* he anticipated the *principle* of Mr. Fryer's propelling apparatus, as described in a recent number of the Mechanics' Magazine. His observations upon the subject were illustrated by a diagram. We are informed, however, that long before Mr. Davis said a word on the subject, the late Mr. Rennie patented a method of propulsion on the same principle.

An indignant Frenchman writes to the *Times*:—"I am told to understand that you go to ask our Emperor to open your Exhibition. I hope in charity you will bring him into the building blindfooled, and so he shall save the miserable indignation we have suffered from looking at your horrid building. Hi! Hi! we mock ourselves at you when we see from the park the big Dome built on boards, and half hid by the big shed. Oh, the ugly brik and the frightful shed to call al Europe to see! Why you bost so much? If you only say we build the shed, then no one laugh. Even the little boy the guide he say 'dam ugly.'"

On Sunday night last, says the *Brighton Times*, the men engaged in boring the Warren Farm well, near Brighton, discovered to their delight a plentiful supply of water. The men engaged in duty came up as usual for refreshments. On going down the shaft to resume work, they were amazed to find that water to an abundant degree had come at last. Their escape was most providential. On measuring the depth of the water, it was found to have risen to the height of *four hundred feet*. This has kept on increasing till, according to the last account, it has reached *seven hundred feet*. The weekly expenditure has been at the rate of £100. The main depth of this celebrated well is about 1,282 feet from the surface.

A short time ago a correspondent of the Philadelphia *Ledger* suggested to artillerists to keep their mouths open when a cannon is discharged, in order to protect their ears from injury. Dr. Von Moeckzisher, the aurist, says that this is a remedy so far as we have a voluntary power of rendering the tympanum tense through the means of the ossicula and their muscles. He adds the following simple, yet useful remedy to obviate many of the injuries to which gunners are exposed. It consists of a solution of glycerine oil and belladonna—say about one ounce of glycerine to fifteen grains belladonna. Saturate a piece of cotton well in this solution, and place it in the ears as far as possible. This solution forms a coating in itself on the membrane, and, with the addition of the cotton, protects the drum of the ear to the utmost extent. When the cotton is removed the coating can be readily washed out by syringing the ear with a little warm water. The preparation will also obviate disease to which the ear is subject from night air and exposure from dampness, and incurred from sleeping in tents and the open field.

A number of gentlemen are about purchasing Ball Mountain, Vt., with a view of trying to domesticate the moose. The entire base of the mountain is to be inclosed by a high fence. The object is to make the moose serviceable in driving singly or by pairs.

The sealed envelopes accompanying the drawings received in competition for the medals and prizes of the Institute of British Architects having been opened, the adjudication of the prizes was found to have been as follows:—To Mr. F. R. Wilson, associate, for his illustrations and description of the Church of St. Peter and St. Paul, Brenckburn Priory, Northumberland, the silver medal of the Institute, with five guineas. To Mr. C. H. Mileham, for his design for a museum of sculpture and painting, a prize in books of the value of five guineas. To Mr. A. W. Davis, for his design for a small market-house and room above, the president (Mr. Cockerell's) prize. To Mr. R. P. Spiers, associate, for his design for a villa (being the second in merit), an Institute prize in books. To Mr. H. S. Legg, associate, for his designs for a small town-hall, and for a railway station, Mr. Tito's prize. To Mr. R. H. Carpenter, student, for his design for a dispensary for a manufacturing town, the student's prize in books. To Mr. S. Fry, student, for the best series of monthly sketches, a prize in books. The design by Mr. W. Hallam, student, R.I.B.A., and that by "Humber" for the president's prize; and those by Mr. S. Fry, and Mr. J. T. Perry, students, for the student's prize, were commended The series of monthly sketches, by Mr. G. Baxter, un., student, was also commended.

The consumption of lucifer matches in this country, at a moderate estimate, exceeds fifty millions daily. This fact alone sufficiently indicates the importance of an invention by Messrs. Bryant and May, of the Safety Match Works, Fairfield, Middlesex, the primary effect of which is to lessen the danger of fire—arising from the use of an article indispensably requisite in every household—whilst it also protects the health of thousands, chiefly children, employed in this branch of industry. The "special safety" of the patent match is that it cannot be ignited by friction, except on the prepared surface of the box, whilst (as is well known) all other lucifer matches not only can be ignited on any hard surface, but combustion frequently occurs from accidental and apparently trifling causes. It has been said that those employed in making ordinary lucifers, are liable to a frightful and inveterate disease, known as "necrosis," caused by the fumes of the phosphorus used in their manufacture, which attacks the jaw-bones—the lower being sometimes entirely destroyed. As the safety match contains no phosphorus, all risk of this distressing malady in its manufacture is effectually prevented. A source of fires (attributable to the use of lucifers) arises from the number of matches, which, not readily lighting, are thrown away, whilst in most cases their combustible properties remain, and, by being trodden on, and in various other ways, the latent fire is evolved, possibly causing a conflagration. This cannot happen with the "safety match," which affords an instantaneous light, as readily as those in common use, whilst all danger of accidental fire is avoided.

Mr. Weale's rudimentary, educational, and classical works, have been purchased by Mr. James S. Virtue, of 294, City-road, who will in future execute all orders. The town trade will be supplied from 26, Ivy-lane. Mr. Weale's elementary series is of world-wide reputation, and it deserves a place in the library of every scientific man.

A meeting of a general committee for originating a memorial to the late Mr. Joseph Locke, was held in the theatre of the Institution of Civil Engineers, Great George-street, Westminster, on the 12th inst. Lord Alfred Paget, who took the chair, said that it was desired to perpetuate the memory of Mr. Locke by the erection of a statue, near those of Mr. Robert Stephenson and Mr. Brunel, with whom he had been associated through life in the construction of those gigantic railways to which Great Britain owes so much of her present grandeur and prosperity. He believed that if an application to the Chief Commissioner of woods and forests as to the site of the proposed statue were supported by the influential gentlemen present, and by the representatives of the Stephenson and Brunel memorials, it would be successful. Mr. J. J. Hope Johnstone, M.P., moved the first resolution:—"That it is due to the memory of the late Joseph Locke, C.E., to record in some appropriate manner his distinguished engineering services, and this meeting is of opinion that a public statue would be the most suitable form of expression of this feeling." The resolution was seconded by Mr. Hawkshaw, the present president of the institute, and carried unanimously. Mr. Moffatt, M.P., moved,—"That subscription lists be opened (limited to 10 guineas) for the purpose of providing the necessary funds." The resolution was seconded by Mr. Cobden, M.P., and carried unanimously. Mr. Bidder, late president of the institution, moved,—"That Lord Alfred Paget, M.P., Sir S. M. Peto, M.P., Sir J. Paxton, M.P., Messrs. J. J. Hope Johnstone, M.P., J. Hawkshaw, J. R. M'Clean, W. Wagstaff, and J. E. Errington, with power to add to their number, be appointed a committee for giving effect to the foregoing resolutions, and that Mr. Charles Manby be requested to act as honorary secretary." This resolution, seconded by Mr. Alderman Salomons, M.P., was also carried unanimously. On the motion of Mr. Beale, M.P., seconded by Mr. Tite, M.P., thanks were voted to the chairman, after which the meeting terminated.

A trial of the engines of the screw steam frigate Aurora, 51, took place outside Plymouth Breakwater on Friday last. The *Times* says the Aurora measures 2,558 tons, and her dimensions are as follows:—Length between perpendiculars, 227ft.; length for tonnage, 196ft. 8in.; breadth, extreme, 50ft; ditto, for tonnage, 49 ft. 6in.; ditto, moulded, 48ft. 8in.; depth of hold, 16ft. 9in. Her engines are horizontal, direct acting, of 400 horses power nominal, by Messrs. Maudslay, Sons, and Field, contracted for in 1854. They are fitted with double-ported slides, like those in the Defiance and Gibraltar. The screw shaft, which is 94 feet 6 inches long by 12½ inches diameter, is in four pieces. The Aurora has been fitted with the late Mr. Joseph Maudslay's patent propeller with feathering blades. The only other ship of war which has this patent is the gunboat Stork, Lieutenant E. Poulden, tender to the Excellent at Portsmouth. It permits of the pitch of the propeller being changed while the engines are in motion. The diameter of the screw is 17ft. The finest pitch is 17ft. 6in., from which position the blades can be turned till they are parallel with the keel, fore and aft, or in a line with what is called the "dead wood," where, while motionless, it will not affect the direction or retard the movement of the ship or the action of the rudder. The regulating power is fitted on the quarter-deck, at the head of the screw-well, where a movable winch acts on a perpendicular rod which places the blades of the screw in any required position. Before the trial of speed at the measured mile the pitch of the screw was altered by two men with great facility on three several occasions, while the engines were going full speed. This result appeared to be very satisfactory to the inspectors.

On Tuesday evening last in the House of Commons Mr. Cowper moved for leave to bring in a bill for embanking the north side of the River Thames from Westminster-bridge, and for making new streets in and near thereto, and from Blackfriars-bridge to the Mansion-house. He gave a succinct history of the schemes for embanking the Thames from the time of Sir C. Wren, and detailed the plan proposed in the bill, which had been sanctioned by a Commission, after the subject had been thoroughly investigated. Its chief features were a roadway by the side of the river to Blackfriars-bridge, and a new street crossing Thames-street and Cannon-street to the Mansion-house. The funds arising from the coal-tax were appropriated to this object by an Act of last year, and the work would be intrusted to the Metropolitan Board of Works. It was not proposed to do anything with the southern side of the river till the impending inquiry had been completed. A question of order arose, whether, as the bill proposed to appropriate a tax, it should not originate in a Committee of the whole House; the Speaker decided the question in the negative. After a debate of some length, in which considerable difference of opinion appeared as to the details of the plan, leave was given to introduce the bill.

Upwards of three million loads of timber and wood were imported into this country, and entered for home use, in 1861; a quantity less by 166,624 loads than in 1860. The computed real value of the entire imports of timber and wood, for the year 1861, fell short of ten millions sterling by seventy thousand pounds only.

Erratum.—In page 183 of our last Number, fourth line of third paragraph, in second column, for "external," read "internal."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2131.

Boilers and their Furnaces, &c., 2113, 2130, 2136.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2145, 2150.

Ships and Boats, including their fittings, 2119, 2125, 2163.

Cultivation of the Soil, including agricultural and horticultural implements and machines, 2155, 2160, 2169.

Food and Beverages, including apparatus for preparing food for men and animals, 2148, 2153, 2158.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2110, 2116, 2122, 2126, 2133, 2134, 2138, 2141, 2165, 2166.

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2117.

Lighting, Heating, and Ventilating, 2120.

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2109, 2114, 2115, 2118, 2123, 2124, 2135, 2137, 2139, 2140, 2149, 2151, 2152, 2157, 2167, 2168.

Metals, including apparatus for their manufacture, 2142.

Chemistry and Photography, 2129.

Electrical Apparatus, 2127, 2147.

Warfare, 2128.

Letter-Press Printing, &c., 2111.

Miscellaneous, 2112, 2121, 2132, 2143, 2144, 2154, 2159, 2161, 2162, 2164.

2109. W. D. Player. *Certain improvements in the description of buttons commonly known as linen buttons.* Dated August 23, 1861.

This consists in forming two eyeletted holes in the shell of the buttons, the holes being made at points equidistant from the centre of the shell, and on the same diameter. The metal situated between the eyeletted holes forms a bar over which the thread is passed, by which the buttons are sewn to the garments. The eyeletted shells may either be covered in front by a perforated disc of linen, the perforations in which correspond with the eyeletted holes, the said disc being fixed to the shell by the eyeletted holes, and the back of the shell being covered with an unperforated disc of linen, or left uncovered. *Patent completed.*

2110. R. A. Brooman. *An improved method of treating the hop plant to obtain a material resembling wool.* (A communication.) Dated August 23, 1861.

The object of this invention is to produce from the hop plant a vegetable wool, or a material resembling wool. To accomplish this the plants are dried, put in trusses, and laid in sheds or barns which must be dry and well ventilated. The plants are then sorted, (for the branches and different parts produce different qualities of wool) and are passed through a crushing machine, to break them up and to crush the knots, which are somewhat harder than the stalks, and contain a resinous gum more tenacious than that in the intermediate parts. The crushed plants are next submitted to the action of stamps or hammers, which beat out the resinous or gummy matter. The vegetable wool, with the waste still adhering to it, is submitted to the action of beaters, which free it from all foreign matters and prepare it to be combed and carded, previous to being spun or otherwise used in the arts and manufactures. Or it may be used without being combed or carded. Among other uses, it forms a valuable material for the manufacture of pulp for paper and other purposes. *Patent abandoned.*

2111. H. Ingle and J. Ingle. *Improvements in printing machines.* Dated August 23, 1861.

This invention relates, firstly, to an improvement upon means of driving the table in printing machines, for which letters patent were granted to Henry Ingle, 14th January, 1858, No. 64. The present improvement consists in substituting for the toothed section in the specification of the said letters patent described, a compound lever, one end of one arm of which is pivoted to one of the upright frames of the machine, while the other end is pivoted to the lower end of the arm, the upper end of which is jointed to the table; the to and fro motion is obtained by a rod connecting the compound lever to a crank on the main driving shaft. The invention consists, secondly, in driving the inking roller, and causing the vibrator to rise at the same time by a ratchet and paul, and adjusting roller, driven by a rod connected by a crank on the driving wheel shaft, or other suitable motor. *Patent abandoned.*

2112. W. Evans and E. Concanen. *A new manufacture of pens or writing instruments.* Dated August 23, 1861.

This relates to the manufacture of such writing instruments of horn, which is first prepared in sheets of suitable thickness in which it retains its natural formation or structure, or it may be dissolved and formed into horn sheets suitable for the purpose. In either case the inventor stamps or otherwise cuts blanks from such sheet horn of a form and size suitable for pens; the blanks so cut are then softened by steam or otherwise, and moulded to the form required, and are furnished with slits, which may or may not terminate in a hole punched in the blanks. *Patent abandoned.*

2113. G. T. Bousfield. *Improvements in apparatus for feeding boilers.* (A communication.) Dated August 23, 1861.

This consists in combining a Giffard injector and the suction pipe thereof with a valve located in the said suction pipe in such a position that it prevents the reflux of the water from the suction pipe when the steam is shut off from the apparatus. Also in combining the Giffard injector, the suction pipe thereof, and the valve before-mentioned with a priming nozzle fitted with a cock or valve, the combination being such that the suction pipe can be primed through the priming nozzle, and that the latter can then be closed. Also in combining the second part of this invention with a tank by a branch pipe leading from the discharge pipe of the injector, which branch pipe is fitted with a cock or valve, so that the tank may be replenished with water by the injector. *Patent completed.*

2114. M. Hyams. *Improvements in the manufacture of smoking pipes and cigar tubes, and preparing, washing, coating, covering, or otherwise impregnating them with aromatic substances in a solid, liquid, or aeriform state.* Dated August 24, 1861.

The patentee claims, 1, the use in or combination with pipe clay, preparatory to moulding pipes or cigar tubes therefrom, of one or more of the following agents, viz., oxide of iron, carbonate of soda, and non-alkaline salts, excepting magnesia, carbonate of magnesia, and silicate of soda as described. 2. The imparting of aroma or aromatic qualities to pipes and cigar tubes substantially as described. *Patent completed.*

2115. J. Driver and J. Jessop. *Improvements in means or apparatus employed in washing, wringing, and mangling fabrics, and in the manufacture of part or parts of such apparatus.* Dated August 24, 1861.

This consists, 1, in a method of constructing metallic rollers and parts thereof used in wringing and mangling machines. 2. In forming the axles of castors or supporting wheels of washing, wringing, and mangling machines in casting the framing thereof. 3 In the principle and means of supporting the axle of the upper of the squeezing rollers in such machines. 4. In forming the metal squeezing roller fluid tight, and with an opening with stopper to each to admit of the hot fluid being introduced and retained therein for heating such rollers, and then of flowing away or being drawn off when desired. 5. In forming the bottoms of the tubs or vessels of washing machines of plain iron cast with ears or other means of connection. *Patent completed.*

2116. W. Clissold. *Improved apparatus for oiling wool.* Dated August 24, 1861.

This relates to the operation of supplying oil or oleaginous mixtures to wool, preparatory to its being submitted to the carding-engine. To this end the patentee employs a travelling brush or brushes, which, after receiving oil from a dipping-plate, will transfer the same to a roller, mounted above the feed-apron of the carding-engine, and pressing upon the wool supplied thereto. The contact, therefore, of this oiled roller with the wool that is passing under it, will ensure the equal distribution of the oil over the whole surface of the wool *Patent completed.*

2117. J. Cranston. *Improvements in the construction of conservatories, orchard houses, and other horticultural erections, which improvements are also applicable to the covering of areas, such as are used for drill sheds, markets, railway sheds, colonists' and army huts, and many other similar purposes.* Dated August 24, 1861.

This applies to horticultural buildings to be constructed of wood and glass, and also to other erections in which the same principle of construction is carried out, but with other materials, all the buildings being pinned and screwed together, and made to rest upon blocks of wood, or butts of trees sunk in the ground, so that they can be erected with great ease, and are portable. *Patent completed.*

2118. H. B. Coathupe. *Improvements in time-keepers.* Dated August 24, 1861.

This consists of an instrument whereby the hour of the day or night is shown with the accuracy of the clock, but without any of the machinery used in clock-work; this result being attained by the action of mercury enclosed in a tube, the detailed arrangements of which we cannot give space to here. *Patent completed.*

2119. M. A. F. Mennons. *Improvements in the propulsion and steerage of ships or vessels, and in the construction and arrangement of the machinery connected therewith.* (A communication.) Dated August 26, 1861.

This invention is not described apart from the drawings. *Patent*

2120. R. W. Jones. *Improvements in heating and ventilating, especially applicable to Turkish baths.* Dated August 26, 1861.

This consists in arranging certain flues, passages, or air chambers, between the heated floor immediately over the heating flues and under the upper floor of the sudatorium and tepidarium, to prevent accidents by burning, to which people are very liable in the hot air bath with horizontal flues constructed and covered in the ordinary way. *Patent completed.*

2121. J. Clark. *Improvements in the manufacture of envelopes and other covers, and in part applicable to the gumming of sheets of paper.* Dated August 26, 1861.

Here a cut or pile of envelopes or other blanks is placed upon a table with the tongue resting upon and projecting slightly over a projecting part of the table edge, whilst adjustable stops at the back keep the blanks in position. A kind of docter is placed and rests with its weight, or is pressed by springs or otherwise, upon the flaps of the blanks, leaving exposed beyond it as much of the tongue as is to be gummed. The gum in a liquid state is allowed to drop regularly upon the exposed part of the tongues, and is also applied at starting to the front of the docter. The blanks are drawn singly and in rapid succession, from under the docter from behind. *Patent abandoned.*

2122. H. Nelson, J. Carr and G. Harrison. *Im-*

Digitized by Google

provements in self-acting mules, for spinning cotton and other fibrous materials. Dated August 26, 1861.

The documents relating to this invention are with the law officers under objection, and cannot at present be seen. *Patent*

2123. G. Nye. *Improvements in apparatus for administering injection in a continuous stream, also applicable as an eye douche and for other purposes.* Dated August 26, 1861.

This relates to two arrangements of apparatus. The first consists of an apparatus in which a vulcanized india-rubber vessel fitted with air valves is affixed at the top of a reservoir intended to contain the water or other fluid, so that, by compressing the india rubber vessel, air is forced into the reservoir, and the water or fluid projected from it in a continuous stream. The reservoir may sometimes be fitted with an injection tube, with stop cock and working on a joint. In the second arrangement of apparatus, a metallic air vessel is employed, enclosing an induction pipe in which is a chamber fitted with a valve for opening and closing the eduction way; at the bottom of the air vessel is secured a foot also fitted with a valve, and at the top of the air vessel is affixed a vulcanized india-rubber vessel, by the alternate compression and expansion or recoil of which, water or other fluid is forced into the air vessel, and thence projected through the outlet pipe in a continuous stream. The valve that opens and closes the eduction way, is so arranged that it may be readily attained, removed, and replaced. *Patent completed.*

2124. A. Lehmkane and C. Nathan. *The manufacture of imitation of embroidery for ladies' collars, cuffs, &c., and all sort of embroidered articles.* Dated August 26, 1861.

This invention consists in the application to the above purposes of embossed and perforated paper, woven fabric, or other suitable material, stamped or cut out in varied designs by dies or tools, the designs being cemented or attached by suitable adhesive material to a ground work of tulle, net, tarlatan, &c., by which the otherwise fragile ornamental design so applied is protected from being torn or injured when made up or applied to the several purposes of the invention. *Patent completed.*

2125. J. L. Field. *Improvements in the construction of armour-plates, and in their application to ships and batteries.* Dated August 26, 1861.

Here the patentee rolls or forms the plates with ribs or projections at the back surfaces, which ribs or projections are the means, when used with suitable bolts or fastenings, of fixing the plates to ships or batteries. It is preferred to use bolts, the inner ends of which are tapped with screw threads to receive screw nuts, the outer ends of such bolts being made forked, so that the ribs or projections formed or fixed at the back surfaces of the plates, may be received between the forks and fixed thereto by rivets or other fastenings passed through the ribs or projections, and the forks of the bolts. *Patent completed.*

2126. F. Tolhausen. *A kind of fur to be made by means of the jacquard or other loom with silk or other textile material.* (A communication.) Dated August 26, 1861.

Here, the textile material intended for the weft, which is composed of several ends, is first sized or dressed in a gelatinous solution, then wound on tubular cops or spools which are exposed to a heat of about 150° F., by which the fibres are curled. By using this weft with the proper jacquard combinations, a piled or terry fabric is obtained, the weft forming the raised pile, which is then cut in the usual way. *Patent completed.*

2127. F. Tolhausen. *A new and economical method of producing dynamical electricity, thereby obtaining useful chemical compounds.* (A communication.) Dated August 26, 1861.

This relates to a new arrangement of piles and batteries having constant and energetic currents, and yielding useful products at the poles of each element. The principle of this method is based on this theory—that the electro motive power of a battery is proportioned to the chemical action that takes place by the contact of a metal and an acid, which chemical action, on the other hand, is directly proportional to the caloric evolved, first, by the oxydation or decomposition of the metal by the acid, and secondly, by the combination of the metal or metallic oxyde with the acid used, the said chemical action being inversely to the absorption of caloric produced by depolarization. *Patent abandoned.*

2128. J. C. Haddan and C. Minasi. *Improvements in the manufacture of projectiles and of cartridges.* Dated August 26, 1861.

This invention comprises much detail which we cannot give space to here. *Patent abandoned.*

2129. W. E. Newton. *Improved machinery for filtering liquids, deodorizing saccharine and other juices, and rectifying alcoholic liquors.* (A communication.) Dated August 26, 1861.

This consists in the use of an apparatus constructed on the principle of the centrifugal drying machine, for the purpose of decolorising saccharine juices and other liquids, and for the rectification of alcoholic liquors, and generally for filtration and for the separation of liquids from impurities. *Patent abandoned.*

2130. H. Attwood. *Improvements in cleaning and in feeding-boilers.* Dated August 26, 1861.

These improvements in cleansing boilers, consist in placing one, two, or more conduits at about the water level; the conduits are dished on their upper surface, and are perforated at intervals, while curved flanges are adapted to the sides. Similar conduits are placed at the bottom of the boiler. The improvements in feeding-boilers consist in supplying them from below, through perforated pipes extending along the length, or nearly so, of the boilers. This arrangement is for the purpose of keeping the sediment in a state of agitation, thereby causing the impurities contained in the water to rise to the surface, when it may be drawn off by the scum plate and cock. For some waters chemical agents are used, together with the above mechanical appliances. *Patent completed.*

2131. Z. Colburn. *Improvements in the arrangement and combination of high and low pressure steam-engines.* Dated August 27, 1861.

By this invention, a portion only of the steam employed in driving a steam-engine is to be previously worked at a high average pressure per square inch above the atmosphere, either in another steam-engine, or in another separate and independent addition cylinder or cylinders of the steam-engine. *Patent abandoned.*

2132. E. Peltier. *Improvements in the manufacture of metallic boxes, and in machinery employed thereby.* Dated August 27, 1861.

This relates to those metallic boxes having six or any other suitable number of sides, and consists in certain improved modes of fixing together the side part or body of the box to the bottom and top or lid thereof, by bezel, sitting or jumped joints instead of soldering, welding, or brazing. The invention is particularly applicable to the manufacture of boxes of tin plate, or other sheet metal, such for instance as are made use of for containing gunpowder or similar articles. *Patent completed.*

2133. L. M. F. Paturau. *An improved thread protecting clew box.* Dated August 27, 1861.

Here the patentee closes each clew in a small capsule, box, or protecting case, by preference made of card-board, fitting round the clew, and provided with a hole through which is left protruding that end of the yarn that is situated in the interior of the clew, thus allowing to wind off any suitable quantity of thread from the clew without fear of the thread becoming entangled. *Patent completed.*

2134. J. Smith and W. Smith. *Improvements in spindles and flyers used in machinery for spinning and twisting fibrous substances.* Dated August 27, 1861.

This method of attaching the flyer to the spindle consists in dispensing with screws, and forming in the top or upper part of the spindle a groove or bayonet slot, and in fixing or attaching a small pin or projection to the inside of the boss at the upper part of the flyer, which locks into the said groove or slot, and thus fixes the flyer at once without screwing. *Patent abandoned.*

2135. J. C. C. Azemar. *The manufacture of an instrument to facilitate the practice of the drum.* Dated August 27, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2136. J. B. Fondu. *Improvements in the construction of fire grates for steam and other boilers, and suitable to all kinds of fires.* Dated August 27, 1861.

This consists in constructing openings (like an open tube) communicating with each other in the length and breadth of the furnace, and permitting the circulation of air received from without, by suitable openings in the front and all over the grate. *Patent abandoned.*

2137. J. H. Johnson. *Improvements in dampers for stamping purposes.* (A communication.) Dated August 27, 1861.

This consists in the use of pieces of sponge covered with cloth or felt placed in a suitable chamber, and supplied with ink from a reservoir suitably arranged. *Patent abandoned.*

2138. R. A. Brooman. *Improvements in the construction of temples or stretching rollers for looms.* (A communication.) Dated August 27, 1861.

The main feature of this invention consists in effecting by one and the same temple or roller, carrying points or needles at or near each end, and extending across the loom, the regular and equal tension on the two salvages of the fabric under manufacture. The rotation of the temple or roller is produced by the onward movement of the fabric, the selvages of which are seized by the points or needles, which are arranged spirally, and inclined outwards from the centre of the roller. A box for holding the temple or roller extends across the loom, and is furnished with bearings for it to revolve in. The box is held to the loom by springs secured to a cross-bar, and the springs are slotted, to enable the position of the temple to be adjusted. The outer ends of the temple are composed of segments, made by preference of copper, tin, or other soft metal, and held on the roller by rings; the needles or points pass through the segments. *Patent abandoned.*

2139. J. M. Hart and R. Lavender. *Improvements in handles and knobs of locks and latches, and in the means of applying them.* Dated August 27, 1861.

Here, when two handles, one on each side of a door, are used, one of them may be made fast to the spindle, as heretofore, and the spindle is formed square, or of other angular form, with a thread cut into the angles to a length likely to be required, and to receive a nut, the external figure of which corresponds with that of a recess in the knob or handle, or so constructed that the turning of the knob or handle will, whilst it turns the spindle, hold the nut from turning thereon. The rosette, or rose, on the inside of the fixed handle is provided with blades or projections in a radial direction, adapted to pass into corresponding saw-cuts in the door; or it is provided with other projections to pass into corresponding recesses in the door, to hold the rose or rosette from turning. At the other end of the spindle there is a supplemental or false rose, or a plate with similar projections to pass into suitable recesses on that side of the door On the opposite side of this supplemental rose, or plate, there is a cylindrical projection with a thread on what may be called the rose proper, or visible, and which is held on to the neck of the knob or handle by a screw ring or nut, or other suitable means. The knob or handle is applied by the screwing-on of the visible rose or rosette on to the supplemental or false rose, or plate; or the rose proper may be attached to the false rose by studs, or projections from the one passing into corresponding receptacles in the other. *Patent completed.*

2140. A. Granger. *Improvements in the manufacture of shirt collars and fronts, wristbands or cuffs, neckties, or other similar articles of wearing apparel.* Dated August 28, 1861.

For the purposes of this invention, in place of making the above named articles of linen, cotton, or other woven fabric, paper cloth or paper as heretofore practised, the patentee manufactures such articles from the following materials, the first of which is generally known by the name of label forril, or bookbinders' cloth, or cotton sheepskin (a material well known and employed for other purposes), the surface of which is prepared with French chalk, starch, and a solution of buffalo hide to thicken and impart a white glazed or enamelled surface thereto; or a preparation of size and chalk may be employed for this purpose. Another material from which he manufactures collars, cuffs, and other similar articles of wearing apparel, according to this invention consists in employing a thin woven fabric, the surface of which is japanned, painted, or prepared with certain pigments, such as are well known and employed for producing a white, glossy, or enamelled surface to such and similar materials for other purposes, in order to varnish and render the same waterproof, and so as in texture to resemble linen or other woven fabric; or a material of this character known by the name of American or leather cloth may be employed for these purposes, the manufacture of which is well known for other purposes; or he employs for the purposes of this invention a material called ass's skin, painted and prepared as is well understood, and similar in character to that which is employed in pocket books for writing upon. *Patent completed.*

2141. J. Ronald. *Improvements in machinery for dressing hemp, flax, manilla, and other like long fibrous material.* Dated August 28, 1861.

This invention consists, mainly, in substituting for gill teeth, brushes formed of bristles, whalebone, prassava, or other animal or vegetable fibre, mounted on rotating cylinders, or their mechanical equivalent, for dressing hemp, flax, manilla, and other like long fibres. *Patent completed.*

2142. B. Browne. *An improved process and apparatus for concentrating ores or tailings or separating pulverized substances of different kinds or qualities from each other* (A communication.) Dated Aug. 28, 1861.

The patentee claims, 1. The process of separating pulverized mineral substances from one another by agitating them in a body of water, or other fluid, and while in such agitated state delivering the mixture into a lower body of water or fluid through which the particles of minerals sink with a velocity according to their specific gravity, and by which the heavier are separated from the lighter, and fall accordingly in different layers upon the bottom, substantially as described and specified. 2. Producing such agitation by passing currents or jets of air through the minerals and the body of water or other fluid containing the minerals, substantially as described and specified. 3. Retarding the descent of the particles of minerals by passing jets or currents of air in an opposite direction through the fluid through which the minerals sink, substantially as described, the lighter particles being more retarded than the heavier particles. *Patent completed.*

2143. W. S. Guinness. *Improvements in sewing machines* Dated August 28, 1861.

In constructing shuttle sewing machines according to one part of this invention, in place of giving motion to the needle, to the shuttle carrier, and to the mechanism for moving the material being sewn, by cams as heretofore usual, or, by what is equivalent thereto, by crank pins working into curved slots in levers, the patentee gives motion to them directly from cranks or eccentrics, a separate crank or eccentric being employed for each of the movements for actuating the shuttle carrier, and the mechanism for moving the material being sewn, and the three cranks or eccentrics are all contained on one shaft. *Patent completed.*

2144. T. Bray. *Improvements in ornamenting wood in imitation of inlaid work.* Dated August 28, 1861.

This invention is carried out as follows:—Firstly, the inventor takes glue, or any kind of glutinous matter, and reduces it to the consistency of jelly; then, with a soft brush, such as is used by painters, gives the clean wood one even coat. Secondly, he takes the following compound, gum elaue, benzoine, and any soft gum which dissolves in spirit, saponis and spermacetti dissolved in pure spirit of any kind, and with this composition draws the desired pattern upon the wood with a pencil, or by the aid of patterns cut as stencil plates, or otherwise. Thirdly, he takes any colour or staining material dissolved in water, and with a brush or tool, such as is used by painters, he grains or stains the whole surface in imitation of the wood, marble, or other substances required to be imitated. Fourthly, he takes pure spirit, and with a brush saturates and washes the whole thoroughly clean, by which means the stain will be removed from the parts of the surface where the composition above mentioned has been applied, according to pattern, but the stain on the other parts of of the wood will not be removed therefrom when the spirit has evaporated. He polishes the surface as may be required. *Patent abandoned.*

2145. S. Carpenter. *Improvements in the construction of carriage wheels.* Dated August, 28, 1861.

For the purposes of this invention in constructing carriage wheels where wood spokes and wood felleys are used, in place of the end of each spoke entering the felley as heretofore, a double metal socket is applied to the end of each spoke, in such manner that the end of the spoke which ordinarily comes next the felley is received into the larger portion of the double socket, while the smaller part of wood which ordinarily passes into the hole or recess formed to receive it in the felley, enters the smaller portion of the double socket, and that smaller portion of the double socket enters the hole or recess in the felley, such hole or recess being made larger for the purpose of receiving the smaller portion of the socket, together with the part of the end of the wood spoke which is therein; but it is preferred that the end of the spoke which enters the smaller portion of the metal socket should be made less than it ordinarily would be, and the smaller portion of the metal socket made exteriorily of the same dimensions as the end of the spoke would be if no metal socket were used. The double sockets may be made of any suitable metal, but it is preferred that they should be made of malleable cast iron. *Patent abandoned.*

2146. J. Duncan. *Improvements in the manufacture of sugar.* Dated August 28, 1861.

Under one modification of this invention, the vacuum pan is arranged and constructed with a series of discs, either solid or hollow tubes, or other generally similar surfaces. These discs or equivalent surfaces are arranged within the vacuum pan, in such a manner as to admit of rotatory or other motion being communicated thereto, the object of fitting these rotatory or moveable surfaces within the pan, being the keeping down the temperature during the boiling operation. Another of the present improvements consists in counteracting the alkalinity of the sugar solution by means of sulphurous acid, which is added in sufficient quantity to neutralize the amount of alkali contained in the saccharine solution. The invention also comprehends an improved mode of reburning animal charcoal, which has been used in the refining of sugar. Under one modification, the retort or vessel in which the charcoal is contained is fitted with a central longitudinal rod or bar, having a series of scrapers or vertical discs fitted to it. Motion is communicated to this rod by means of suitable gearing, so as to cause it to move to and fro, as well as rise and fall. In this way the rod (with its scrapers) is caused to move longitudinally and vertically, and so cause the charcoal to be pressed forward by the action of the scrapers, and thus render the process of burning continuous. As the rod with its scraper moves to and fro in its elliptical path, it continuously brings forward, and exposes a fresh supply of the animal charcoal to the heated surface of the retort, thus effecting a considerable saving of time as compared with the ordinary mode. *Patent abandoned.*

2147. M. Theiler. *Improvements in type-printing telegraphs.* Dated August 28, 1861.

This invention consists in a novel arrangement and construction of the type-printing instrument whereby chronometry is dispensed with, the instrument being worked by means of a key similar to that of a single needle or a Morse instrument The letters are engraved or fixed on the periphery of a wheel or disc, and they are united by a band, or in any other well-known manner. The strip of paper, or the tape upon which the messages are to be printed, is passed before the type-wheel by block-work, and is struck by a hammer of the block-work against the wheel, when the required letter presents itself before it. An escapement wheel, actuated by a spring, is mounted upon the axle of the type-wheel, and is held in its position by a hook or catch. Two levers are applied for raising this hook, each of which is moved by an electric magnet, when a current passes through its coil; and when the hook is raised, and the escapement liberated, each of the two levers will take into a part of the escapement, thereby allowing the escapement and type-wheel to perform only a certain portion of a revolution. The principal part of the instrument is the escapement, which has its teeth arranged so as to stop the type-wheel at any one of its divisions corresponding with the number and order of currents employed. These currents are produced by a local battery, and pass alternately through one or the other of the magnets by means of a double relay, able to serve or open the way alternatively to the one or to the other of the magnets. This double relay is worked in either the one or the other of the two connectors, by reversing the line current by means of a key similar to a single needle, or a combination of such with a Morse key. The block-work which is at rest after having performed all the functions connected with the printing of a letter, is started by the motion of any of the escapement levers, but directly stopped again, and only allowed motion to complete the next letter when the levers are at rest. *Patent abandoned.*

2148. S. Corbett. *Improvements in mills for crushing and grinding mineral and vegetable substances and for hulling or shelling beans and oats and other grain and seeds.* Dated August 29, 1861.

This invention consists, 1, in the improvement described in fixing in the said mills the flat or conical revolving, grinding, or cutting plates or surfaces, by which, with the fast or stationary plates or surfaces, the grinding, crushing, or hulling is effected. The invention consists, 2. In the improvement described in fixing in the said mills the fast or stationary grinding or cutting plates or surfaces, by which, with the revolving plates or surfaces, the grinding, crushing, or hulling is effected. The invention consists, 3. In adapting springs to the spindle carrying the revolving grinding or cutting plate or surface of mills, so as to make the said plate yield and adjust itself to any irregularity of pressure, and thereby to prevent accident to the said plate, or to the mill, in case of nails or other hard substances accidentally getting between the grinding or cutting surfaces. The invention consists, 4. In the improvement described in feeding the grain or other matters to the improved mills. The invention consists, lastly, in constructing the grinding or cutting surfaces of the rotating and fixed plates or discs of mills as described with reference to the drawings. *Patent completed.*

2149. J. Harding. *An improved inverness cape.* Dated August 29, 1861.

According to this invention, instead of allowing the wings of the cape to be open down the front, as is now the case, the inventor stitches them fast to the body, so that they cannot fly open and annoy the wearer, yet allow the free use of the arms, and by this means the cape is more readily adjusted to the figure. *Patent abandoned.*

2150. J. Love. *An improved signal.* (A communication.) Dated August 29, 1861.

This signal may be used on railway trains, or for any purpose for which it may be found applicable. When used on railway trains it consists of a metal tube running along the roof of each carriage, with a moveable joint at each end (worked by springs), to allow carriages to be coupled or uncoupled. The last carriage of the train has that end of its tube which is furthest from the locomotive, blocked, and the end of the tube, or series of tubes next the engine is stopped by a sounding box or gong fitted to the tender. The signal is given by a small rifled revolver fitted in a rest, with a long trigger and crank in a round barrel, open at top, and sliding within another barrel, similar to the slide of a telescope. This portion of the apparatus is inserted into the roof of each, or any of the carriages under the tube, and opening into it. In signallizing, it is only necessary to press up the inner barrel until it receives the catch, and the revolver goes off. The said inner barrel must then be restored to its normal position, or it would interfere with the action of the apparatus in other carriages. The ball so discharged from the revolver strikes the metallic plate or gong. the driver answers by his whistle, and stops the train, the action of the signal being simple, certain, and instantaneous. *Patent completed.*

2151. V. A. Janvier. *Improvements in fastenings for gloves, belts, and other articles.* Dated August 29, 1861.

The inventor forms a fastening, so contrived that the parts of the glove which it immediately connects, may be brought nearer to or from each other at pleasure. For this purpose he employs a rack, and causes a piece to travel thereon, or work therein, to open or close the fastening to the required extent, preferring to connect the portions of the fastening to the glove, by forming them with bent parts, which hook into holes in the opposite sides of the opening of the glove, whereby the fastening may be easily connected and detached. *Patent abandoned.*

2152. P. Jewell. *Improvements in concertinas.* Dated August 29, 1861.

Part of this invention consists in applying an additional row of studs at each end of a German concertina, in combination with suitable mechanism for sounding the semitones of the chromatic scale, each stud of such additional row being arranged in such manner that it will, when suitably acted on, sound one or other of two semi-tones. And another part of the invention consists in applying to German and other concertinas, parallel plates of glass, interior of the instruments opposite, but at a short distance from the holes or air passages, by which the tones of the instruments will be modified and improved. *Patent abandoned.*

2153. A. V. Newton. *Improved machinery for clea .ing rice and other grain.* (A communication.) Dated August 29, 1861.

This invention relates to that class of rice-cleaning machines, in which a revolving or archimedian screw or spiral wings are employed to force the grains of rice or other products against and past each other, and by the rubbing and friction of their surfaces to clean the same. The improvements consist, first, in extending upwards the rear end of the cylinder or case containing the screw, and through which the grain is passed for the purpose of being cleaned, so that the extended end may receive a corresponding telescope slide, by adjusting which vertically, the length of the passage for the grain may be increased or diminished. The telescopic slide will, therefore, enable the weight and resistance of the rice forced through the said upright extended portion, by the screws, to produce the required degree of friction, and rubbing of the surfaces of the grains of rice requisite for effectually cleaning the same. As a further improvement, it is proposed to use a peculiarly-formed hopper, divided by a vertical partition into two compartments, either of which is capable of being brought at pleasure into connection with the cylinder containing the screw. The divided hopper is not, however. essential to the efficient working of the machines. *Patent abandoned.*

2154. R. Penrose. *Improvements in screw stocks and dies.* (A communication.) Dated August 30, 1861.

This invention relates to stocks of dies for screwing or forming the threads on gas pipes or similar articles, and the improvements consist in having the stock or frame part of the apparatus so formed or constructed as to become a guide to the die, and having the die, which is made taper in the cutting part, placed at a small distance from the side of the ground, but parallel to and concentric therewith. By means of this apparatus screws can be cut at one operation with more accuracy and greater facility than heretofore. *Patent abandoned.*

2155. L. D. Owen. *Improvements in ploughs.* (A communication.) Dated August 30, 1861.

The patentee, according to this invention, makes the working surface of the mould board in the form of a section of the interior surface of a hollow cylinder, the centre or axis of the said cylinder being parallel or nearly so horizontally to the base of the mould board or bottom of the plough. He makes the plough point with a coulter or cutter rising from it, nearly perpendicular, of sufficient height to cut or divide the soil that is to be turned from the land side. *Patent completed.*

2156. R. Shaw. *Improvements in windlasses, capstans, and other machinery for hoisting and lowering weights.* Dated August 30, 1861.

This invention consists in so constructing and arranging the several parts forming the break that it is in operation while the weight is being hoisted, and when it is raised, consequently, if the man at the handle should let it go, the weight remains suspended until the break is released; and by this means the injury and accidents resulting from the man at the handle being overpowered by the weight, or the handle breaking or coming off, are avoided. One mode of performing the invention is by applying one or more pails to the wheel on the drum or other shaft; these pails take into an internal ratchet wheel formed in the break pulley, which is surrounded by a friction clip. The details of construction may, however, be considerably varied and modified. *Patent completed.*

2157. A. J. Daumont. *An improved umbrella.* Dated August 30, 1861.

The object of this invention is to prevent an opened umbrella from being upset or losing its shape by the action of the wind. For this purpose, towards the outer end, each rib of the frame of the umbrella is connected by means of a string, tape, small chain, or other similar tie, either to the runner or slide of the stick, or to a special moveable ring or runner. It is desirable the above mentioned ties should offer sufficient elasticity for allowing the ribs to yield sufficiently to the impetus of the wind, and they must be arranged in such manner, that, when the umbrella is shut, they may be hidden from sight in the interior thereof. *Patent abandoned.*

2158. S. Pluchart. *An improved beverage called Moka-beer.* Dated Aug. 30, 1861.

This improved beverage is manufactured as follows, viz: —300 parts by measure of fermented strong coffee; 300 ditto of tapa; 65 ditto of a solution of sugar and gum senegal; 10 ditto of an alcoholic extract of bitter orange peel; 325 ditto of water. The liquid thus obtained is mixed in equal proportions with aerated water, or made up with an equal proportion of water into an aerated beverage, and forms the Moka beer; or the liquid may be drunk without any addition of water. *Patent abandoned.*

2159. A. Taille. *An improved manufacture of manure.* Dated August 30, 1861.

This improved manure may be divided into a first and second composition. The patentee composes the first exclusively of animal matters, such as waste horn of every description, hoofs, hair, or wool, scrapings or parings of hides, and all other animal remains obtained from tanneries, leather cuttings of every description, and old leather. He places all these matters in a digester boiler, into which he introduces steam from a second boiler by a conducting tube leading from one boiler to the other. He raises the pressure of the steam to three or four atmospheres, according to the hardness of the matters under treatment, which also serves to guide him as to the length of time they should be submitted to this high pressure, which is exercised according to circumstances from fifteen to twenty hours, by which time the matters will be entirely and completely dissolved either into a marmalade, if they have been placed in the boiler in a slightly moist state, or, if more thoroughly charged with moisture, into a liquid state. The matters being dissolved, he withdraws them from the boiler, and places them in a malaxing or kneading machine, which completes their intimate admixture; and at the moment of effecting this amalgamation in the kneader he add a certain quantity of bone in impalpable powder. This compost is then, if it be winter, placed upon a drying apparatus, if summer it is simply dried in the sun, and finally it is submitted to mill stones to be pulverized to the fineness required. *Patent completed.*

2160. W. E. Gedge. *Improvements in thrashing machines.* (A communication.) Dated August 30, 1861.

The object of this invention is to render thrashing machines capable of separating and purifying the seed of clover, lucerne, red hay, and other plants fit for fodder, and these improvements consist, 1. Of an iron plate solidly fixed along the entire length of the counter beater of a thrashing machine of any description, such plate being pricked with a graver until rasping teeth are raised close together and well defined; above it is secured by small bolts passing through the openings of the grating to a band of iron which receives them. This plate forms very slightly prominent ribs, following the rods of the counter beater which serves to support it. 2. of an arched plate bolted to the blades of the beater; this plate is also pricked with the graving tool into rasping teeth, slightly more prominent than those of the counter beater; these teeth seize and press the layer of plants from which the seed is to be removed upon the counter beater, where they are torn and crushed by the activity of the beater. 3. Of a sorting sieve for separating the straw from the flour, and facilitating the purification of the seed. This sieve is suspended to a frame by flexible leather bands, which lend themselves easily to the necessary motion; a light wooden pallet with handle is added to bring the layer to the mouth of the machine. *Patent abandoned.*

2161. H. W. Spencer. *Improvements in the manufacture of animal oils, the said improvements relating more particularly to the processes of refining them, to be used for lubricating purposes.* Dated August 30, 1861.

The patentee claims the process of purifying or refining animal oils, by removing from them gelatinous, albuminous, or such like substances, which they contain, in order to render them more useful for lubricating purposes, by means of the introduction of nut galls, or other such like substances, containing tannin, or tannic acid, in the manner, and in the proportions described. *Patent abandoned.*

2162. J. S. Matthews. *Improvements in the manufacture and preparation of starch.* Dated August 30, 1861.

The first division of this invention relates to the manufacture and preparation of starch and starchy matters by a new and economical process from roots, cereals, and grain commonly employed for such purposes, as potatoes, arum corms, wheat, rice, oats, Indian corn, sago, and such like substances, either in the whole or in the ground state, also from other roots, cereals, and grain, lichens and algæ, not employed for such purposes, as Jerusalem artichokes, mangold wurtzel, parsnips, hyacinth and other bulbs, broad beans, haricots, peas, lentils, carragheen moss, chondrous crispus, cetruria islandica, and such like. The second division relates to the mixing and combining of the different starches and starchy matters produced from the foregoing substances, in such proportions as shall best suit the purposes for which the starch is intended to be used. The third division relates to the preparation and employment of a variable alkaline or incombustible composition in the manufacture and preparation of the starch, and in the mixing and preparation of starch or starches already manufactured, which shall render it incombustible, or non-inflammable in its use with all kinds of fabrics, even those of the finest texture, such composition being varied to suit the use of the starch for which it is intended *Patent completed.*

2163. J. Harris. *Improvements in stopping or retarding railway and other carriages and trains, locomotive and stationary engines and machinery, together with apparatus employed therein, which apparatus is applicable to the raising and lowering of weights and other purposes for which power is required.* Dated August 30, 1861.

The present invention is for improvements on a former invention for which letters patent were granted to the present patentee 24th January, 1857 (No. 216), and consists chiefly in the employment of air-tight vessels or reservoirs made of metal or other material fitted with safety valves and pressure gauges, and placed in some convenient part or parts of railway or other carriages, on an engine or tender in an engine-house, manufactory, mill, on board ship, or other position. The patentee connects with one or more of those vessels, and communicating therewith by air-tight pipes, cylinders fitted with pistons, the rods of which are attached to the brakes or brake levers on one or more or all of the carriages, as well as the engine and tender. The vessels or reservoirs have air forced into them by means of an air-pump or pumps, which are fitted to the carriage, engine, or tender, and worked by either eccentrics, or other appliances from the axles of such carriage, and so arranged as to be hrown in and out of gear as required. The pump may also be worked by hand, wherever brakes for stopping or etarding machinery, or the means of quickly opening or losing of cocks or valves for shutting off steam, gas, or vater may be necessary. The air-pump communicates irect by air-tight pipes with the vessels for containing the ompressed air. There are also pipes leading from the essels to the cylinders in connection with the several rakes, and in those pipes, conveniently placed, is a three ay cock or valve to be worked by hand. The vessels, hich for convenience may be placed under the seats in ilway carriages, are always kept charged with compressed r by means of the air-pump, so as to operate instantaneously and simultaneously when required on all the akes. To cause them to so act, a cock or valve is opened, hich allows the compressed air to act upon the pistons onnected with the brakes, the amount of pressure which quite under control being regulated by circumstances. he brakes are immediately liberated on reversing the reeway cock or valve, which allows the air to escape from e cylinders; slightly modified the apparatus may be made actuate ships' rudders and the heavy valve gearing in arine and other steam engines and to move other bodies. *atent completed.*

2164. H. Lecauday. *Improved apparatus for succouring rsons interred before life is extinct.* (A communication.) ated August 30, 1861.

Here the inventor screws on the inside or through the of the coffin a tube, which is so arranged as to cover or near the mouth of the recumbent. The outer end of tube is to be so placed as to allow the outer air to netrate into the coffin, and at this end of the tube is iced any means of conveying sound, such as as a pistol, . These may be so arranged, that, when a spring hich will be so placed as at the slightest movement of hand it will act on the means of sound, that may used as a signal,) is released the desired signal will be en. *Patent completed.*

165. C. Woams and J. Warburton. *Improvements in tting animal fibre recovered from rags, composed of ed animal and vegetable fibre.* Dated August 30, 1861. This consists in preparing fibre to be again manufactured fabrics by the combined process of carding, or other- e preparing it, and then combing it; the process of ding opens out, and, to some extent, straightens the e, whilst the combing process separates the short from long. *Patent abandoned.*

166. J. Bishop. *Improvements in the manufacture or ring of velvet or other pile fabrics.* Dated August 30,

ccording to this invention the patentee uses several ns or rollers for the top warp, and several top warps, h should contain, however, no more material than the top warp on the old plan, the material being equally led out to each beam or roller. He also uses two ts or lambs, and "rises" one shaft or lamb at a time, one bottom roller and warp, and two shafts or lambs, h should contain no more than half the quantity of rial upon the old plan of rising and falling alternately, ho "rises" one bottom warp shaft; also he uses two es or lines between every wire. *Patent completed.*

7. H. Brann. *Improvements in mattresses formed springs.* Dated August 30, 1861.

re the inventor constructs spring mattresses in two, , or more pieces, and prepares for each part a suitable and laths stretched across to receive the springs, as bands or strips of canvas to pass over the springs, as ; the whole is then enclosed in canvas, with the tion of the faces that abut against each other when d together, which are left open; the edges of the s, at the parts of the mattress joined together to form le, are united by lacing straps, or otherwise, to render attress complete. *Patent abandoned.*

3. W. Clark. *Improvements in shirts and chemises.* mmunication.) Dated August 30, 1861.

invention is not described apart from the drawings. *t completed.*

W. Hensman and W. Hensman, jun. *Improve- in apparatus for tilling land by steam-power.* August 31, 1861.

relates, 1, to the windlass, and consists of a shaft ne on wheels, which carries a pair of drums, upon the traction rope is wound, revolving by pipes or upon the main axle; the outer rear of each drum hed. On each side of the shaft frame there is an t bracket to which a compound lever is jointed. the drums there is a horizontal shaft, having at one rigger to receive a band from the steam-engine, and nions which gear into the toothed rims of the drums. aft works in bearings on the levers before-men- the ends of which are connected to brakes acting ne drums. Each drum, with its pinion lever and is independent of the other. The improvements in tors consist of a frame or carriage mounted on ng or furrow wheels, and furnished with steering lling apparatus, which frame carries two or more for the attachment of ploughshares, tines, or other tors, so as to be adjustable to any required width h of furrow. The plough and beams may be so ar- as to be easily reversed at the end of each furrow niversal joint. The inventors prefer to use an im- form of plough, with an adjustable coulter turn are, and sliding shield, to lay the furrow slices all one way.' The tines are two-edged, with or without cross blades, and have a dovetailed hole in the centre, through which the stern is passed and secored by a cross-pin. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Jan. 10, 1862.

72. R. Johnson, Liverpool, master mariner. An improved composition for coating the bottoms of iron ships to prevent their fouling, and which composition may be used as a protective coating for wood, iron, or other substances exposed to the action of sea water.

Dated Jan. 17, 1862.

128. J. C. Dickey, Saratoga Springs, Saratoga, New York. An improved quartz crusher.

Dated Jan. 28, 1862.

227. W. Irlam, Gibraltar Iron Works, Newton Heath, Manchester, engineer. Improvements in the construction of railway crossings and turntables.

Dated Jan. 29, 1862.

237. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in machinery for puddling metals. (A communication.)

Dated Jan. 30, 1862.

251. A. C. B. Maiols, boot maker, Paris. Improvements in the manofacture of boot and shoe heels, and in machinery to be used therein.

Dated Feb. 11, 1862.

350. W. H. Weaver, Edington, Bridgenorth, Salop, agricultural engineer, and C. Gall, Bridgenorth, engineer. Improvements in machinery for cultivating, ploughing, harrowing, or scarifying the land.

351. T. Fyfe, 46 Leicester-square, engineer. Improvements in knapsacks, and in apparatus for supporting them or other similar burdens upon the shoulders.

359. R. Johnson, Manchester, wire drawer. Improvements in welded wires used for telegraphic and other purposes.

Dated Feb. 13, 1862.

375. W. E. Newton, 66 Chancery-lane, C.E. Improvements in projectiles. (A communication.)

377. J. Peters, Ulverston, engineer. Improvements in portable steam engines, applicable to locomotive, stationary, and marine engines.

379. W. Williams, Bath, pianoforte maker. Improvements in pianofortes.

381. A. C. Ebbutt, upholsterer, 25 Blackman-street, Borough. Improvements in reclining, easy, and other chairs.

385. F. Falconer, Glasgow, warehouseman. Improvements in glasses for lamps.

Dated Feb. 15, 1862.

405. W. Avery, Birmingham, screw manufacturer. Improvements in machinery for the manufactore of screws, a part or parts of which improvements may also be used in the manufacture of pins, rivets, and nails.

Dated Feb. 17, 1862.

423. E. T. Hughes, 123 Chancery-lane. An improved method of and apparatus for collecting the gases given off from furnaces. (A communication.)

424. T. Birdsall, Leeds, chemist, and J. Birdsall, tanner. Improvements in preparing hides or skins for tanning.

Dated Feb. 18, 1862.

429. C. D. Ségoffin, 2 Rue Sainte-Appoline, Paris. An improved apparatus for the purpose of viewing photographs on cards.

Dated Feb. 19, 1862.

437. H. B. Barlow, Manchester. Improvements in carding or otherwise preparing cotton and other fibrous materials, and in machinery employed therein. (A communication.)

438. J. Nasmyth, 31 Rue de l'Etoile, Brussels, C.E. Improvements in apparatos for obtaining a circular motive power.

442. J. Turner, 194 Upper Thames-street, baker. Improved machinery for mixing, mincing, and poonding materials to be used in the preparation of food.

443. W. Hinton, Greville-street, Holborn, barometer manufacturer. Improvements in barometers.

445. J. Paterson, Middle Temple, barrister at law. Improvements in means or apparatus for re-burning animal charcoal. (A Communication.)

447. G. T. Bousfield, Loughborough-park, Brixton. Improved modes of protecting iron boilers, tanks, and vats from wear arising from galvanic action. (A communication.)

Dated Feb. 20, 1862.

449. G. F. Lee, New Bridge-street, solicitor. An improvement in tourniquets. (A communication.)

453. J. Bleasdale, roller manufacturer, and P. W. Bordale, mechanic, Accrington, Lancanster. Improvements in fluted rollers for preparing and spinning fibrous materials, and in the mode of manufacturing the same.

455. J. Paterson, Middle Temple, barrister at law. Improvements in the use of animal charcoal. (A communication.)

457. C. Wood, Bramford, Suffolk, engineer. Improvements in horse rakes.

Dated Feb. 21, 1862.

461. H. Ward, Castle Bromwich, farmer. An improvement or improvements in ladies' saddles.

463. W. Hamer, Little Lever, near Bolton, cotton spinner. Improvements in apparatus employed in the preparation of cotton and other fibrous materials.

464. E. S. Crease, 17 Gracechurch-street, mining engineer. Improved machinery for drilling, boring, or excavating rock or other earthy substances.

466. J. Krasuski, 29 Boulevart St. Martin, Paris, professor. An improved apparatus for controlling fiery horses.

Dated Feb. 22, 1862.

473. A. Bornemann, 29 Monmouth-street, Bath, cabinet manufacturer. Improvements in the mode of constructing fountains.

477. J. Townend, Bradford, York, machinist. Improvements in jacquard engines.

479. D. B. White, Newcastle-upon-Tyne, doctor of medicine. Improvements in apparatuses for protecting liquids from the atmosphere while remaining in and during their discharge from the vessels containing the same.

481. G. J. Oram, 19 Wilmington-square, watch manufacturer. A revolving pendant for giving greater security to watches and lockets against theft.

483. W. B. Johnson, Manchester, consulting engineer. Improvements in steam engines.

Dated Feb. 24, 1862.

485. W. Johnston, Glasgow, metal merchant. Improvements in gas and other lamps and stoves.

487. J. and R. Cunningham, Paisley, card perforators. An improved ornamental fabric, and improvements in weaving and in jacquard apparatus.

488. J. C. Haddan, Bessborough-gardens, Pimlico. Improvements in small arms and in artillery, and in projectiles for artillery.

491. W. Clark, 53 Chancery-lane, engineer. Improvements in apparatus for feeding or supplying steam boilers with water. (A communication.)

493. P. G. B. Westmacott, Newcastle-upon-Tyne, C.E. Improvements in constructing and supplying armour plating to ships, vessels, and forts.

495. L. Davis, Gloucester-gardens, Hyde-park, Esquire, and F. M. Parkes, Marylebone-road, gentleman. An improvement in the production or manufacture of gas for lighting and heating.

496. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in reaping and mowing machines. (A communication.)

497. F. St. G. Smith, Drogheda, Ireland. Improvements in machinery for grinding or reducing quartz, bones, grain, and other substances. (Partly a communication.)

Dated Feb. 25, 1862.

503. J. Piddington, 52 Gracechurch-street. Improved condensing apparatus, adapted for high-pressure steam engines, especially locomotive engines. (A communication.)

505. W. Clark, 53 Chancery-lane, engineer. Improvements in tobacco pipes. (A communication.)

506. T. Watson, Thornton, near Bradford, York, overlooker, and R. Dracup, mechanic. Improvements in means or apparatus for preparing and combing wool and other fibres.

511. W. Mc I. Cranston, 58 King William-street. Improvements in machinery for reaping and mowing. (Partly a communication.)

512. C. Kingsford, Fenchurch-street, merchant. A new composition for the manufacture of bread.

513. P. J. Guvet, Paris, C.E. An improved coupling for uniting pipes between locomotives and tenders, applicable also to the coupling of other pipes.

514. H. W. Cook, Manchester. An improved mode of and apparatus for propelling carriages and vehicles by means of electricity.

Dated Feb. 26, 1862.

515. J. Boocock and T. Davenport, Bury, mechanics. Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.

517. A. Stephen, jun., Glasgow, ship builder. Improvements in the construction of ships or vessels.

523. T. King and R. Varvill, Liverpool, merchants. Improvements in apparatus for controlling the flow of fluids for flushing water-closets.

525. W. Miller, Upper Stamford-street, Blackfriars. Improvements in the manufacture of sugar.

527. W. Clark, 53 Chancery-lane, engineer. Improvements in the clasps or fastenings of bracelets, neck chains, and other articles of jewellery. (A communication.)

529. W. P. Savage, Roxham, Downham, Norfolk. Improvements in fire-arms.

531. J. Smith, sen., Coven, near Wolverhampton. Improvements in drying wheat and other grain.

Dated Feb. 27, 1862.

535. W. A. Gilbee, 4 South-street, Finsbury. Improvements in the construction of fire grates for steam and other boilers, and suitable to all kinds of fires. (A communication.)

536. W. Smith, Salisbury-street, Adelphi. Improvements in the method of making cigarettes, and in the apparatus and materials to be employed therein. (A communication.)

537. J. Tangye, Birmingham, manufacturer. An improvement or improvements in hydraulic lifting jacks.

539. T. Bray, Dewsbury, York. Improvements in ornamenting wood in imitation of inlaid work.

541. J. R. Foster, Winsley-street, Oxford-street, trimming manufacturer. Improvements in the manufacture of bullion-fringe or cord.

543. J. Revell, Dukinfield, Chester, master plasterer and decorator. Improvements in oil cans.

Dated Feb. 28, 1862.

544. P. D. Azemar, Paris, watchmaker. An improved mechanical arrangement for the winding up and the setting of the hands of watches by means of the knob of the pendant.

545. W. H. Muntz, Millbrook Lodge, Hants, gentleman. Improvements in paddle wheels.

546. A. W. Makinson, Westminster, C.E., and W. F. Batho, Birmingham, mechanical engineer. Improvements in locomotive engines.

547. J. C. Ratliff, Coventry, ribbon manofacturer. Improvements in the covers or binding for books and blotting cases.

548. G. McKenzie, W. P. Murray, and J. Hamilton, gentlemen, Glasgow. Improvements in machinery or apparatus for the manufacture of bobbins or holders for textile materials.

549. J. Pollock, 27 Budge-row, stationer. Improvements in apparatus for protecting trousers from mud.

550. J. L. Charcoochet, Lyons, C.E. Improvements in machinery for breaking stone.

552. J. Parker, 6 Lilford-road, Camberwell, Surrey, solicitor's managing clerk. An improved mode of applying steam as a motive power for propelling vessels, and for other purposes.

Dated March 1, 1862.

553. T. Cowburn, Little Peter-street, Manchester, engineer. Improvements in apparatus for raising and discharging boiling soap, and for dividing the same into bars when congealed.

554. T. Bradford, Cathedral Steps, Manchester, washing machine manufacturer. Improvements in washing machines for cleansing domestic garments, fibrous materials, and for manufacturing purposes.

557. M. Dodds, Bedburn Iron Works, Hamsterley, Durham, edge tool manufacturer. Improvements in machinery for moulding, forming, or shaping articles of iron or other malleable metals, and for shearing or cutting such metals.

558. P. H. Boyer, Paris, glove maker. Improvements in the manufacture of boots and shoes.

560. M. and A. Gabriel, 33 Ludgate-hill. Improvements in the bases of artificial teeth.

561. S. Hague, Westwinstead, Litchfield, America, cutler. Improvements in machinery or apparatus for raising hammers and stamping with them hot or cold metals.

562. A. E. Ragon, 4 Bernard-street, Russell-square. Improvements in electric alarums for telegraphic purposes. (A communication.)

563. A. Potts, Cappagh, Down, Ireland, farmer. Improvements in machinery or apparatus for scutching and refining flax, hemp, and other vegetable substances.

564. P. Robertson, Sun-court, Cornhill. Improvements in treating yeast, and in the manufacture of ammoniacal salts, and a substitute for animal charcoal.

565. S. G. Reynolds, Bristol, U.S. Certain improvements in power spading machines.

566. J. G. Jennings, Holland-street, Blackfriars, sanitary engineer. Improvements in the construction of chimneys or flues.

567. J. B. Kendall, Boston, U.S. An improved horse shoe.

568. L. Martin, Tenison-street, York-road, Lambeth, and O. Penfold, Blackmoor-street, Drury-lane. An improved candle lamp.

569. C. Boolds, South-terrace, Kennington-park. Improvements in fastenings for gloves.

570. J. W. Davis and F. Davis, Hull. Improvements in apparatus for supplying feed water to steam boilers.

571. H. Bowen, Cardiff, gas engineer. Improvements in gas meters.

Dated March 3, 1862.

574. T. Bell, Wishaw, Lanark, manager. Improvements in apparatus for distilling shale and other bituminous minerals.

575. A. Sheldon, Tipton, Stafford, furnace builder, and J. Sheldon, West Bromwich, Stafford, furnace builder. An improvement or improvements in smelting furnaces.

576. J. Schofield, Huddersfield, York, machine maker. Improvements in looms for weaving.

577. A. Tevendale, Liverpool, licensed victualler. Improvements in the apparatus used in connection with cooking stoves and domestic fire-places for the manufacture and supply of gas.

579. A. Bedborough, Southampton. Improvements in pillar letter boxes and letter bags.

580. J. B. A. Quiquandon, Paris, mechanician. Improvements in jacquard machines, and in the pattern cards to be employed therein.

581. G. Bischof, jun., Swansea. Improvements in treating ores and solutions containing copper and iron, or either of them, to obtain products therefrom.

582. W. Conisbee, Herbert's-building, Waterloo-road, engineer and printing machine manufacturer. Improvements in colour printing machines for letter-press or block printing.

583. H. Bunning, Field House, New-cross, Deptford. Improvements in the manufacture of lubricating grease or compounds.

584. F. B. Houghton, 6 Clarendon-terrace, Kensington. Improvements in the manufacture of paper.

Dated March 4, 1862.

587. B. Standen, Salford, near Manchester, chemist. Improvements in the preparation or manufacture of portable manure or fertilising compound, and in the collection or extraction therefrom of a certain liquid applicable to various purposes, and also in machinery or apparatus to be employed therein.

588. P and F. Schafer, Golden-square, manufacturers. An improvement in travelling bags, portmanteaus, and other similar bags and cases.

589. J. T. Smith, Lee, gentleman. An improved sight for fire-arms, applicable also as an apparatus for measuring angles

590. W. Tongue, Bradford, York, engineer. Improvements in machinery for breaking, rubbing, and scutching flax, hemp, or other vegetable fibrous materials, and in processes for treating silk waste.

591. A. J. Sedley, 210 Regent-street. Improvements in metallic bedsteads, sofa bedsteads, and folding chairs or seats.

593. T. Greenwood, Leeds, machine maker. Improvements in sewing machines.

594. G. F. Guy, Bury St. Edmonds, gentleman. Improvements in electro-magnetic motive power engines.

Dated March 5, 1862.

596. W. Tongue, Bradford, York, engineer. Improvements in machinery for preparing silk, flax, hemp, or other fibrous materials.

600. T. Bostock, Stone, Stafford, boot and shoe manufacturer. Improvements in the manufacture of boots and shoes.

602. F. N. Gisborne, 3 Adelaide-place, London-bridge, engineer and electrician. Improvements in the mode of indicating numerals or letters in railway tickets and other articles by peculiar devices cut therein, and in apparatus for effecting the same.

Dated March 6, 1862.

604. J. Barker, Todmorden, York, engineer, millwright, iron and brass founder. Improvements in, and means or apparatus for, casting drums, pullies, gear, and other wheels and bushes or keys for the same.

606. T. Hack, West Middlesex Water Works, Hammersmith, and A. E. Carter, West Middlesex Water Works, Kensington. Improvements in screw cocks.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2780. J. B. Love. Combining and securing the sides of navigable vessels.

2781. J. P. Bourquin. Ornamenting the covers of albums and other articles.

2783. H. Orth. Soap.

2787. A. Prince. Furnaces. (A communication.)

2792. J. Walmsley. Looms.

2794. A. W. Williamson. Steam boilers.

2798. H. G. Gibson. Drying grain. (A communication.)

2806. J. Tyler. Clarionets.

2808. J. H. Johnson. Treatment of carpets. (A communication.)

2809. J. Byrne. Scutching and refining fibrous substances.

2811. D. Cowan. Tubes.

2815. F. H. M. C. D. C. F. de Lacombe. Illuminating.

2816. S. Hague. Manufacture of hoes.

2819. J. Fisher. Indicating or regulating the passing of railway trains.

2824. W. Clark. Filters. (A communication.)

2825. F. O'Reilly. Table.

2830. J. J. Shedlock. Gas meters.

2835. R. Bellis. Laying wood floors.

2836. J. Davidson. Communicating.

2844. L. F. Duval and L. A. Beaudet. Tanning.

2845. M. Henry. Treating iron. (A communication.)

2847. T. B. Collingwood and A. Butterworth. Spinning and doubling.

2851. E. C. Kemp. Gas lamps and fittings.

2853. L. Rolland. Door shutter.

2856. J. Vaughan. Manufacture of bayonets.

2859. F. Coney. Stock for brooms.

2862. A. E. Carter and T. Hack. Screw cocks.

2865. H. R. Fricker and J. Manley. Cleansing sewers.

2875. J. Nixon. Ventilating.

2876. J. Spratt. Preparation of food.

2883. J. C. Goodall and J. Beale. Folding envelopes.

2885. E. Estangus. Drawing teeth.

2899. J. Mundella and W. Onion. Looped fabrics.

2909. J. Schloss. Pouches.

2914. F. Johnson. Screws.

2940. M. Henry. Steam engines. (A communication.)

2980. F. A. Calvert. Fibrous substances.

3001. S. A. Carpenter. Attaching name plates or labels.

3019. J. Cooper and C. Garrood. Horse hoes and horse rakes.

3083. R. A. Brooman. Treating atmospheric air. (A communication.)

3222. T. E. Vickers. Wheels.

57. W. Bradshaw. Watches.

196. J. H. Johnson. Removal of incrustation. (A communication.)

206. S. A. Carpenter. Covering and combining strips of steel for crinoline skirts.

251. A. C. B. Malois. Manufacture of boot and shoe heels.

302. E. F. Smith and T. Swinnerton. Manufacture of coke.

357. J. H. Johnson. Smoothing irons. (A communication.)

381. A. C. Ebbott. Chairs.

404. J. H. Johnson. Electro-magnetic time-keepers. (A communication.)

405. W. Avery. Manufacture of screws.

413. J. Chatterton and W. Smith. Telegraph cables.

440. W. B. Adams. Springs.

445. J. Paterson. Re-burning animal charcoal. (A communication.)

448. J. Wilcox. Manufacture of frills or ruffles. (A communication.)

455. J. Patterson. Animal charcoal. (A communication.)

528. E. G. Bruzaud. Pianofortes.

543. J. Revell. Oil cans.

552. J. Parker. Propelling vessels.

567. J. B. Kendall. Horse shoe.

587. P. Standen. Preparation or manufacture of portable manure.

590. W. Tongue. Treating silk waste.

596. W. Tongue. Fibrous materials.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated March 14, 1862.

2298. T. Morris, R. Weare, and E. H. C. Monckton.
2300. S. H. and E. H. Jones.
2302. W. E. Gedge.
2312. F. M. and E. L. Ransome.
2315. F. Wrigley.
2316. F. Barnett.
2319. G. Davies.
2320. J. and W. Statham.
2321. J. Lee and B. D. Tappin.
2323. G. White.
2328. E. Partington.
2331. E. Suckow and E. Habel.
2333. L. G. A. Condroy.
2341. W. T. Tongue and J. Greer.
2342. J. H. Wilson.
2380. A. J. Sedley.
2390. T. Bright and R. Mills.
2589. T. E. Merritt.
2740. E. A. Maling.
15. J. Howard and E. T. Bousfield.

Sealed March 18, 1862.

2339. E. Breffit.
2347. R. P. P. Dagron.
2351. J. Oliver, J. Grantham, W. Sinnock, and M. R. Leverson.
2353. J. C. Davidson.
2355. J. Burnand.
2359. F. W. Wymer.
2362. C. Board.
2363. H. & F. C. Cockey.
2365. W. Stableford.
2368. S. Desborough.
2369. J. H. Doley.
2373. H. Brinsmead.
2376. J. Price.
2377. J. Jacob.
2381. G. J. Gladstone.
2391. H. Purnell.
2416. J. Kimberley.
2422. J. A. Knight.
2440. F. Walton and R. Beard.
2486. J. Tweedale.
2548. S. R. Carrington.
2632. J. H. Johnson.
2802. T. C. Darby.
3201. T. Green, W. Green, and R. Mathers.
298. W. E. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

631. J. C. and F. Piggott and G. Mallinson.
640. R. Waller.
641. R. A. Brooman.
649. W. Langton.
653. W. Clark.
706. W. C. Cambridge.
761. G. Hazeltine.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

555. J. M. Napier.
571. J. Marland.
574. E. J. Mitchell.
647. J. Willis.
741. P. R. Jackson.
801. S. Holt.
845. E. E. Allen.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending March 15, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
1961	0 10	1971	0 3	1981	0 7	1991	0 7	2001	0 9	2011	0
1962	0 10	1972	0 3	1982	0 6	1992	0 10	2002	0 7	2012	0 9
1963	0 6	1973	0 7	1983	0 7	1993	0 4	2003	0 3	2013	0 3
1964	0 6	1974	0 3	1984	0 3	1994	2 6	2004	0 6	2014	0 4
1965	0 3	1975	0 11	1985	0 3	1995	0 9	2005	0 3	2015	0 1
1966	0 6	1976	1 2	1986	0 3	1996	0 3	2006	0 3	2016	0
1967	0 10	1977	0 10	1987	0 10	1997	1 2	2007	0 3	2017	0 3
1868	0 3	1978	0 2	1988	0 3	1998	1 0	2008	3 2	...	3
1969	0 7	1979	1 0	1989	0 6	1999	0 10	2009	0 4	...	...
1970	0 3	1980	0 7	1990	0 6	2000	0 3	2010	0 3		

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, March 20, 1862.

		£	s.	d.		£	s.	d.	
IRON:									
Rails in Wales and North of England	pr. ton	5	5	0	to	6	0	0	nett
Welsh Bars, in Wales	„	5	5	0	„	1	7	6	„
Staf. Bars, at the Works	„	6	10	0	„	7	5	0	„
„ Hoops	„	7	10	0	„	8	5	0	„
„ Sheets, Singles	„	8	5	0	„	9	0	0	„
„ Nail Rods	„	5	15	0	„	6	10	0	„
„ Boiler Plates	„	8	0	0	„	8	10	0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	9	0	„	2	9	3	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	0	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	98	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	99	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9¼	„	0	0	0	3½
STEEL.									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	16	0	0	„	0	0	0	„
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	4	12	0	„	0	0	0	net
„ Straits	„	0	0	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I.C.	„	1	1	0	„	1	4	0	„
LEAD.									
Pig, English	pr. ton	19	10	0	„	20	0	0	2½
„ Spanish	„	19	0	0	„	19	10	0	„
Common Sheet	„	21	10	0		22	0	0	„
Tea „ (Wimshurst's Patent) A special disct.	„	35	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	18	0	0	„	0	0	0	nett
For arrival	„	18	5	0	„	18	7	6	
ZINC:									
English Sheet	„	26	0	0	„	0	1	0	1
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	3

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 28, 1862.

SIR SAMUEL BENTHAM.*

[FIRST NOTICE.]

The volume before us, the life of Sir Samuel Bentham, is calculated to increase rather than to diminish the public regard for those men who, apart from the glare and the glory of war, pursued "the even tenor of their way" in the midst of difficulties and discouragements, and bore forward the standard of scientific progress until they had planted it on the loftiest heights of civilisation. Sir Samuel Bentham was the youngest son of Jeremiah Bentham, of Queen Square Place, Westminster, and was born in the year 1757. His only surviving brother (ten years his senior), was the celebrated Jeremy Bentham, whose name and fame are world wide. Very early in life, Samuel showed some mechanical predelictions, and soon exhibited a strong desire to gain a knowledge of the art of shipbuilding. At school he had distinguished himself from the generality of his fellow scholars, and at the early age of fourteen, or in fact a few months earlier, he was placed as an apprentice to the Master Shipwright of Woolwich Dockyard, Mr. Gray. At the same time, "a distinguished master of mathematics," Cowley, of Woolwich Warren, was engaged to give the embryo shipbuilder lessons in that science. So satisfactory was the pupil's progress that he actually wrote a treatise on mathematics before completing his apprenticeship; this was said to exhibit unusual ability. From Woolwich, Bentham went with Mr. Gray to Chatham Dockyard, and was there "frequently gratified by intercourse with men distinguished in various branches of science." Like Telford and others, who knew the value of time, Bentham allotted different parts of the day to his different occupations. In a note-book which still exists, he has set down the manner in which his time was apportioned while at Chatham. "Geometry before breakfast; working shipbuilding between breakfast and dinner; Mr. Davis (his tutor) with me from dinner to six, while I am drawing. Music just before dinner, and light reading immediately after." It is clear, too, that Bentham studied at the same time a variety of other subjects, as for example, chemistry, electricity, painting, and grammar, especially that of the French language. Naturally observant, he became early alive to the abuses which existed in the Royal Dockyards, and thus were implanted in his mind those seeds of dissatisfaction with things as they were, which finally germinated, and made him a determined reformer and vigorous advocate of economy in public expenditure.

At the early age of fifteen, Bentham invented a chain pump, which on the advice of Mr. Gray, he brought under the notice of the Navy Board. The members of this body, while "admitting the improvement, and commending the inventor's ingenuity," declined to adopt the plan, as they *already had a contract for pumps.* Sapiency thus appeared to be then paramount at the "Board," as it has frequently proved to be at other boards, which have sat since. This discouragement, nevertheless, seems but to have sharpened the inventive faculties of Bentham, for we soon find him contriving several other improvements in reference to naval matters. Among these was an instrument which he termed a *curvator*, and which was adapted to the measuring of crooked timbers. Having at length completed his apprenticeship, he wisely determined to devote yet more time to educational pursuits, and to this end visited London, attended lectures of the learned societies, and acquired a knowledge of the German language. Hence he went to Portsmouth, became a pupil at the Naval Academy there, and after gaining further information and practice in shipbuilding, entered as a volunteer on shipboard, under Lord Keppel. At a time when the question of steering ships of war has acquired an importance and an interest which can scarcely be over-rated, it may not be *mal a propos* to give an extract of a letter which Bentham wrote to his brother on the subject in 1778, and while serving in Keppel's fleet. He says, "On Monday last, I dined on board the Formidable, with Captain Barclay, when, on being introduced to Sir Hugh Palliser, that gentleman recollected me. During my stay on board, I projected an alteration in the apparatus for steering, the purpose of which was to make it easier; when I mentioned my plans, the master and carpenters began swearing at themselves for not having thought of the same thing." Part of the apparatus was afterwards taken to the dockyard to be altered, but instead of this, a new one was made under Bentham's directions. Subsequently, Captain Jarvis, afterwards Earl St. Vincent, expressed his approval of the improved steering arrangement, and complimented the inventor upon it. This incident commenced an acquaintanceship between Jarvis and Samuel Bentham, which finally ripened into lasting friendship.

In the summer of 1779, Lord Howe, then First Lord of the Admiralty, suggested that Bentham, instead of accepting any immediate employment at home, should spend some time in visiting maritime countries abroad, to study the shipbuilding and naval economy of foreign states. This advice was acted upon, and armed with letters of introduction to persons of eminence, he embarked on the 24th August, 1779, on board a Dutch eel boat for Helvoetsluys. On the 31st of the same month, he arrived at his destination, and forthwith commenced his tour of naval inspection. The Dutch were early distinguished for their proficiency in shipbuilding, and at Amsterdam especially the young tourist derived some valuable hints both as to that art and the mode of preserving timber. The administrative as well as the executive departments of the naval establishments of Holland, obtained a share of his attention, and thus he obtained information as to their management and expenditure which in later years was valuable nearer home. Bentham next visited the ports of the Baltic, gleaning facts in his progress, until at Mittau the Grand Duke of Courland obtained for him his first offer of place and pecuniary emoluments. These, however, he declined, and in March, 1780, we find him at St. Petersburgh, suffering from the effects of an accident consequent on the overturning of the carriage in which he travelled.

In Russia, thanks partially to the letters of introduction he had brought, but more to the reputation for talent he had honestly acquired, Bentham was soon offered an important post under Government—that of Director-General of Mechanical and Shipbuilding Works. This again he declined, as he saw its acceptance would expatriate him probably for life. After visiting Cronstadt, Bentham set out on a tour through the interior of Russia, and made his way thus to the seaports of the south. In the course of this journey, many accidents and incidents, pleasant and otherwise, befel the tourist; but those who desire to know more of these, must have recourse to the pleasant and most instructive volume itself.

With admirable diligence and perseverance, he travelled on through the vast territory of the Czars, making notes by the way, and missing no opportunity of adding to his stock of knowledge. In August, 1781, he determined to visit the great factories of the Russian Empire, "to investigate their mode of management, and to improve himself in the art of metallurgy." The mines in the Ural Mountains claimed and obtained notice, and at length he reached Archangel. Although the climate of Russia is an intensely cold one, the warmth of hospitality on the part of its inhabitants, or at least of those with whom Bentham came into contact, seemed to compensate fully for it, and he was more embarrassed in his journeyings by the number of presents he received than by any other cause. In Siberia this was the case to a remarkable extent, and in after life he told many amusing anecdotes of the straits to which he was reduced in ridding himself of the abundance of gifts which politeness had compelled him to receive, or rather not to decline.

The gold and copper mines of Siberia, of course, were visited, and specimens of the ore from each were transmitted to England. Afterwards the celebrated iron factory of Nijni Taghil demanded his notice and gained it. At this place Bentham gained a considerable amount of local fame by his construction of an *amphibious* carriage. The peculiarities of the weather in the district prompted this idea; for sudden thaws following heavy falls of snow, inundated the country frequently, and endangered the lives of travellers. Without going into a minute description of the amphibious vehicle, it may be said that for water service, the wheels were easily detached, and stowed away in the bottom, where they served as ballast. When the carriage-boat was completed, Bentham made trial trips in it by water and land, much to the amusement of the inhabitants, who probably had never experienced a "sensation" before. Engaged one day to dine with the Governor, Bentham, just before the appointed hour, sailed up the river, in full view of the well-filled windows, in his amphibious conveyance. After dinner, the same vehicle, on wheels conveyed him to his residence. Bentham's stay in this locality was particularly agreeable, and was proportionably prolonged. At length he set out for Catherineburg and Perme. At this last place, he left traces of his visit in the shape of improvements in the mode of raising salt water for the purpose of crystallization. He also visited a cavern celebrated for its minerals, and of this so interesting a description occurs in the volume before us, that we regret being unable to find room for it here.

The Russian authorities facilitated in every way the movement of Bentham, and thus added materially to his comfort and convenience, and under these circumstances he advanced to the very frontiers of China. Of the manners, customs, and traffic of the inhabitants of the border districts of the two monster empires, much instructive information is given in the "Life of Sir Samuel Bentham," but limited space forbids our transcription of it here. After further explorations of Siberia, our hero returned by way of Novogorod and Moscow to St. Peters burgh, where he arrived on the 9th of October, 1782. Here he prepared a paper for the consideration of the Empress, and suggestive of improvements in the modes of working the mines and saltworks of the Government of Perme. Prince Potemkin presented it to her

---

* The Life of Brigadier-General Sir Samuel Bentham, K.S.G., formerly Inspector General of Naval Works, lately a Commissioner of His Majesty's Navy, with the distinct duty of Civil Architect and Engineer of the Navy. By his widow, M. S. Bentham. London: Longman and Co. 1862.

Majesty, who deigned to approve it, and to ask for further details. These were soon forthcoming, as was a chart which Bentham had invented for displaying at one time the state of the population of the whole, or any part of the empire. The empress ordered a chart of one province to be made on this plan.

These and other circumstances served to detain Bentham in St. Petersburgh, and the Empress appointed him a Conseiller de la Cour, with the civil rank of Lieutenant-Colonel. The works of the Fontanha Canal were given him in charge, and here his old *penchant* and talent for mechanical invention induced his contrivance of a pile-driving machine. Next "an affair of the heart," well nigh ending in marriage, with the wealthy niece of Prince Galitzin, occupied his mind, but this was finally "broken off," as the phrase is, and those who wish to know how or why, must refer "for further particulars" to the "Life of Sir Samuel."

A journey to the Crimea followed the termination of the little bit of romance to which we have referred, and Mr. Bentham found a field for the practice of his knowledge of mechanics, for the Prince Potemkin entrusted him with the control of his factories at Cherson and elsewhere.

Other honours and duties followed. Hitherto he had had the rank and received the pay of a Lieutenant-Colonel without being attached to a regiment, but now he was given the command of a battalion. Complete ignorance of military matters did not exempt him from service, and it is amusing to note the ingenuity with which he sought to conceal his deficiencies in this respect. In 1786 his brother Jeremy paid him a visit, and on his arrival at Cricpoff he found Samuel engaged in the construction of a pleasure yacht for the Prince Potemkin. The yacht was of a novel kind. It was 252 feet in length, and 16 feet 9 inches in breadth. "That "it might accommodate itself to the windings "of Russian rivers, it consisted of six separate "boats, so connected by a peculiar mechanism "that no interval was left between boat and "boat greater than the diameter of a small "iron pin." From these peculiarities, it obtained the very appropriate name of the Vermicular.

As Bentham had but little military occupation for his battalion, and no love for military exercises himself, he converted a considerable number of his men into shipwrights and sailors. The fitting out of a flotilla to oppose the Turks, who had lately shown a desire to commence hostilities against Russia, afforded practice for this process of conversion. The flotilla was armed, put to sea, and in an attack made upon it by the Turks, the latter were most decisively and disastrously beaten. Bentham, however, was not enamoured of either military or naval glory, as he remarked after this engagement, that "fighting for once in a way is well enough, "but it is an abominable trade to follow." Soon after, he gave up his regiment, and repaired to a new command in Siberia. Here he organised many improvements, which were honourable in the highest degree to himself, and invaluable to those for whom they were designed, but we cannot now specify them more exactly.

"He had found the remote and, in part, un-"civilised Siberia," whose very name in England was fraught with painful suggestions, "a "country rich in natural productions, the "people in towns (especially at Tobolsk), of "highly cultivated minds and manners, and "society, free from the restraints imposed "upon it by the near seat of Government. "Siberia, indeed, was ever after in his thoughts an earthly Paradise." Thus writes in the volume before us the amiable and talented widow of Sir Samuel Bentham, the productions of whose pen have frequently enriched the pages of the MECHANICS' MAGAZINE, but who has not survived, unhappily, to see that volume in the hands of an admiring public.

It remains for us to conclude the first notice of the instructive book in question by stating, that Bentham returned from Siberia to England, on leave of absence, in 1790. His official career in England must form the subject of our second notice.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER. V.

EVENTS recorded in the latest telegrams from America have corroborated in so remarkable and unquestionable a manner the opinions expressed in my letters on the subject of iron armour, that it will not be out of place to bring them prominently to the notice of your readers.

I refer to the naval victory gained by the iron-clad Confederate frigate Merrimac over a Federal fleet, of which the following is a brief report:—

"The Merrimac received the broadsides of "the Cumberland and Congress at 100 yards "without sustaining any damage. The Merri-"mac then ran into the Cumberland with her "iron prow literally laying open her sides; she "then drew off, fired a broadside into the "Cumberland, and again dashed at her, knock-"ing in her side, and left her to sink."

"In the morning the Federal iron-plated "steamer Monitor was attacked by the Mer-"rimac. These two vessels fought five hours, "during which they nearly touched each other, "the Monitor finally succeeded in forcing "a hole in the port side of the Merrimac. "The Monitor was uninjured."

The *Times*, which persistently maintained that no iron armour could resist the terrific effect of Armstrong guns is now driven to make the admission that "a vessel can be "made practically invulnerable even to the "heavy naval guns which at present are in "use," and goes on to say that "had it not "been for the Federal iron-plated ship, "Monitor, the Merrimac might have destroyed "the whole Federal squadron."

By a singular combination of coincidence and inconsistency, the *Times* in its naval intelligence of the same day, in describing the fortifications for the defence of Chatham Dockyard, congratulates the country on the fact "that the excellent "position in which the new guns are mounted, "combined with their enormous calibre (110 "and 68 pounders), would make it *impossible* "for any hostile vessel to force the naturally "intricate estuary of the Medway," and declares that the double chain of fortifications will "render a successful attack on either "Chatham or Sheerness impossible."

We are thus brought into the heart of the question propounded in my first letter—the immense importance of which to our national defences I have more than once adverted to.

If ships can be made invulnerable, land batteries of the most formidable character will be of no avail to prevent the entrance of an armour-plated fleet into a harbour or a river. As projectiles could not damage or stop the passage of the ships, they would steam past the batteries without wasting their ammunition in returning the fire, and be able to destroy a dockyard, or set a town in flames, or lay it under contribution, without the possibility of resistance. The only way to meet this imminent danger is to possess a fleet of armour-plated vessels, practically invulnerable, by adopting the best methods of construction.

To repel the assaults of an invading enemy the battle would be fought between opposing iron clad squadrons, and the most securely protected ships would gain the victory. The five hours' contest between the two American iron-sides, the vessels almost touching each other, proves that armour-plated ships might pass by batteries of the heaviest guns, at long range, unmolested, and the fact that finally the Monitor's fire having penetrated the plates of the Merrimac the latter was obliged to draw off, proves that in this new class of ships of war the perfect efficiency of the armour is the great desideratum. If from defective fastening or backing a plate is knocked off or penetrated, the ship which is so damaged will be speedily destroyed by her adversary pouring in missiles through the aperture.

ON THE BACKING OF ARMOUR PLATES.

There is no part of the structure of iron armour which claims more serious consideration than the nature and mode of application of backing to the outer protective plates. In all the first arrangements for the construction of iron-plated ships, and of experimental targets, little or no attention practically was paid to this matter. There were two theories—the elastic and the rigid—which divided the opinions of scientific and thinking men; each had its partizans, and even now, in the face of the evidence of facts and experiments condemning the elastic principle, it is still advocated by engineers whose names are an authority.

To show how little regard was paid to cause and effect in experimenting on iron plates during more than two years, it may be recorded as a curious fact that, in target trials, and in testing plates, wood was invariably applied, as the back support, either in the form of the sides of a Trusty, or some other weather-beaten and decayed hulk, or in that of timber butts set up at the practising grounds. Many trials were made without any backing at all, as in the case of the Thorneycroft bars, or with plates of which the edges only were supported on a wooden frame. But the influence which wood as a backing had in the results of those experiments, seems not to have been considered. Hence, it has occurred in numerous experiments that effects on plates, which have been taken as evidence to determine the quality of iron, or the thickness of plate requisite to resist a given projectile force, ought to have been attributed to the nature of the backing or to its absence. A similar disregard to the effect of backing is to be found in the descriptions of numerous inventions recommending spaces behind plates "to be filled in with wood "or any other material," as if it were a matter of indifference.

To exemplify and arrive at the true theory of backing there can be no better method than to describe some of the results of the hap-hazard mode of making trials which I have referred to, and which for some time prevailed.

In experiments on plates fixed on the oak planks of the Trusty, the Java, or the Stork, or on wooden butts, the iron, when hit by projectiles of sufficient force was invariably crushed into the wood. Other plates, fixed on a frame forming merely a bed for the plates to rest upon, without any pretension to be considered as a backing, were not only fractured at the points of impact, but extensively injured by cracks in all directions. In testing at Shoeburyness some beautiful hammered plates manufactured from scrap iron, at the Government works, at Portsmouth, the experiments proved an absolute failure, because the plates were laid on a frame, and held by screws and nuts at the edges, without being supported by backing. They were starred like a pane of glass, and completely shattered into angular pieces. Here vibration was the cause of the mischief; the wooden frame being too slight to afford any support to the plates, the elasticity of the iron was brought into play, and the plates broke as a spring breaks from over tension. Backing and vibration stand in the relation of cause and effect. The want of backing or a backing, offering an insufficient resistance, has, in some experiments, been the cause of destruction to plates of extraordinary thickness. In the trial of a target on the Thorneycroft system (see Fig. 6 and 7 in my second letter), bars 10 inches in thickness were burst asunder, and large pieces broken off short, shewing a bright granulated texture, like steel, although the iron was of excellent malleable quality. This result was reported in glowing terms in the *Times*, and mentioned in Parliament as evidence of the astounding force of the Armstrong guns; but it was entirely due to vibration, owing to the absence of backing, and to nothing else. Nevertheless, it was held forth as a great triumph to artillery against iron plates, whilst it really proved the total disregard to the subject of backing which prevailed at the time.

The experiments referred to require revision. They were not fair tests of the quality of iron or of the resisting force of any given thickness of plate, because the nature of the backing was the influencing cause of the results, and disturbed the accuracy of the conclusions drawn from them. These experiments, therefore, may be regarded as abortive.

In the results of other trials, the advantage of iron backing to plates is plainly discernible. Numerous instances can be adduced, placing the point beyond a doubt; but the evidence would occupy so much space, it must be reserved for another communication. In the meantime, however, it will be convenient to continue the argument on backing.

From the two, and very different, kinds of effects resulting from experiment an unmistakable theory is deducible. The backing to armour plates to be perfect should be as hard and rigid as iron itself; wood, whatever may be its use to absorb concussion and prevent vibration is of no avail, as backing. When employed for that purpose, it becomes the source of destruction to plates, for, as it offers comparatively no resistance to projectiles, it is the direct cause of plates being fractured, distorted, and broken away from their fastenings. Having determined that a hard and rigid backing is an indispensable condition of a perfect system of armour plating, we are brought to consider the application of the theory in practice.

The first point which demands attention is, the distinction to be made between the penetrating and crushing effect of projectiles on iron armour. Careful observation of the actual results of experiments lead to the conclusion, that a small amount of thickness, say 2 to 3 inches of wrought-iron, of good malleable quality, is sufficient to resist the penetration of cast-iron shot, whatever may be their weight or momentum. That is to say, if the backing and its support are not crushed or indented by the concussion of impact, the shot will, by its own force, be broken into fragments against a plate of that thickness, and will not penetrate through it. If this be true, it follows that the all-important matter in armour plating is the nature of the structure which composes and supports the backing. That will be the subject of future consideration; but it may here be said that to attain the requisite strength and rigidity of structure, the construction of iron ships will probably undergo a complete revolution which will call into action the combined science and skill of the naval architect and engineer.

To arrive at a fair test of iron plates they must be in close contact with and firmly fastened to a backing which will not yield to a blow transmitted through the plate. When a plate being struck bulges behind the point of impact, it is either because there is no backing or because the backing is not of sufficient hardness, rigidity, or strength to oppose the required amount of resistance. Place a half-inch iron plate on an anvil, and strike it with a sledge hammer, and hardly a perceptible impression will be produced; place it on a block of wood, and give it a similar blow, a deep indent will be made in the iron; or take a card—fix it securely on a smooth deal board with small tacks at the edges, and strike a smart blow on it with a hammer. The card will show a slight indentation on the surface, but will not be penetrated or materially injured. Place the same card on a sheet of felt about an inch thick, fasten both to a board with pins through the edges of the card. Strike with a hammer, as before, the card will be crushed in at the middle, and torn away from the pins at the edges. This experiment, which can easily be tried, is an apt illustration of wood backing to iron plates. The difference of hardness and density between iron and wood is greater than between card and felt.

The want of attention to the back support of plates in experimental practice will probably be found to have given rise to many false conclusions. The received estimates of the power of projectiles to penetrate plates are founded on data which may prove to be erroneous, if the nature of the backing has not been taken into account. It is no answer to say plates were tried under similar conditions, for altered conditions may affect different qualities of iron differently. The particular quality which placed on wood readily yielded to the blow of a projectile, might, with a more rigid backing, prove to be better calculated for defensive armour than another quality of iron which bore the test better with a wood backing. And, on the other hand, with a hard and rigid backing a particular quality of iron, which, with wood backing, was easily fractured, might better repel projectiles than a quality which, with wood backing offered greater resistance. Space will not admit of this branch of the subject being further discussed on the present occasion. Enough has been said to show its importance.

ARTILLERY PROSPECTS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The lectures on the various systems of rifling delivered at the United Service Institution in the Spring of 1861, indicated some mistakes in the Armstrong plans of compressing the shot, as well as in the coil system of manufacturing the guns. We will now give some additional facts and fuller details, which will tend to prove that the Armstrong weapons, although they have, by clever combinations, produced striking results, are wanting in the essentials for naval guns. These weapons require a special training in the men who are to work them, and an amount of care and nicety difficult under the most favourable circumstances, and impossible of attainment in an action at sea. If the delicate rifling of these guns becomes at all affected by rust from salt water, or foul from the residuum of the powder charge, or lead coating, all their accuracy is gone. And should the rifling become injured by an enemy's grape or canister shot (which would probably often occur) and the structure of the guns happen to escape damage, they would be useless for firing their own peculiar projectiles, and become of little or no service for any other ammunition.

As broadside guns, the largest Armstrong's (lately called 100 pounders) are very inferior to the old smooth-bore ordnance, and unless most expensive projectiles of wrought iron are used, they can do little or nothing against armour plates. At 200 yards the 68 pounder produces more than double their effect, under any circumstances, and this advantage is maintained up to 600 yards, at which distance the velocities of both the elongated Armstrong and the round balls are too much reduced to penetrate three-inch plates with a backing. Within 600 yards the 68 pounders are as accurate as the Armstrong's even in target practice on shore; but at sea, on the unstable platform of a ship's deck, the former are loaded with ease and certainty, but the latter from *hanging fire*, and complicated adjustments, very often fail in accuracy, while suffocating fumes from the lead and the wad compositions not unfrequently poison the air between decks.

Were it not possible to combine the smashing powers of the round ball, with the advantages of the elongated powder, and Shrapnell, or segmental, shells, for throwing which accurate rifling is so valuable, it might be well to sacrifice a good broadside gun or two, and to replace them by these delicate Armstrong's; but when such a combination has been obtained by France, Austria, Sweden, and Sardinia, and can be easily effected by us without sacrificing a single advantage of either weapon, it really does appear unwise to supply guns for naval work, which throw projectiles costing upwards of twenty shillings a-piece (Elswick price for cast-iron covered with lead), when the 68 pound round balls made in the Arsenal at about three shillings and sixpence each are so much more destructive against plates.

By giving up the lead coating, which Sir William himself has virtually condemned, and wishes to abandon for all guns above (if not inclusive of) 40 pounders, and by adopting an iron projectile with a simpler form of groove, large molten iron shells could be advantageously fired, and our vast accumulations of stores in all parts of the world still made use of; but if the lead coating plan be persevered in, these will be lost to the country, and molten iron, for which such preparations have been made on board ship and on shore, must be abandoned.

Nor is this all, the opportunity of bringing the guns upon one deck to a single calibre, and simplifying our armaments will pass away, and we shall have a mixture of various natures of Armstrong ordnance (with perhaps a sprinkling of other target guns) quite unsuited to maritime warfare. Apart from the great caution required in working the Armstrong guns, they can neither give their projectiles sufficient velocity to crush armour plates nor withstand the blows of hostile shot. Moreover, if the guns do escape destruction by shot, they will as surely, though more slowly, be destroyed by the lengthened time the breech of the gun is acted upon by the powder charge; this longer period is owing to the detention of the leaded projectile until it is wedged through the neck of the chamber by which it is throttled, and has rifled itself against the numerous fine grooves along which it is squeezed, until on reaching the muzzle, it is again throttled and then driven clear of the gun.

The muzzle nip will perhaps be given up, and a slower twist of rifling adopted for new guns, but no compromise or succession of alterations, involving costly charges on all points, can remove the radical defects of the lead-coating plan.

This plan, well enough adapted to the infancy of rifling, is very unsuitable to the present mechanical skill of England, which can fit any form of shot to any shape of grooving, and it is now being given up by nearly every inventor in favour of simple iron shot.

For daily practice these breech-loaders are unsuited, as a reduction in charge, to save expense, occasions further difficulties with air space, and lessens the accuracy of fire. The costly compound projectiles also cannot be refired, as used to be done with the round balls fired from our gunnery ships, and from our practice grounds; but were iron projectiles and suitable rifling adopted—especially with large guns—the great saving of re-firing inexpensive projectiles could be again effected, and rifled ordnance, accurate with very low charges, need not, like the Armstrong, be kept trained up to the top of their work in ordinary practice.

Should the present fine grooving be retained, the guns will be only able to fire their own compound projectiles, which are so delicate as to be liable to injury from a blow or fall, and it is a matter of grave doubt whether they will keep serviceable in a tropical climate.

In war the expense of the leaded shot, which have been supplied from Elswick at three times the cost at which elongated iron projectiles can be manufactured in the Arsenal, would be very great, and as the guns rapidly deteriorate from use, and would break up if hit, the cost of a naval war with such weapons would be truly enormous.

As respects our cast-iron guns, they are still being supplied in great numbers, but of a "form" unsuitable for rifling, and they are inferior to the cast ordnance of Prussia, Sweden, and America; and although our cast iron is not so well adapted as theirs for the present requirements of artillery, we have Bessemer's process, which is under trial in Belgium, and by which cheap and good metal can now be produced. Besides Bessemer's steel, the Mersey Company are making capital field pieces of rolled iron, which are cheap and sufficiently tough to withstand blows from hostile shot; and this Company has also produced heavy guns forged hollow, which are well fitted to withstand close battering, and were a coil tube, extending from breech to trunnions, to be placed over these forgings, and a shorter hoop over the seat of the charge, they would make very strong, durable, and powerful broadside guns. And while the French, Spanish, Austrians, Italians, and Northern States of America have been reducing their guns to a few uniform calibres, and have rifled, and then strengthened them on the Blakely plan, our engineer of rifled ordnance has thrown aside most of the brass pieces, and added to our great stock of cast ordnance a large number of wrought-iron guns, all with sizes of bore which cannot take the old ammunition.

That the rifling and fittings of these built-up pieces are far from meeting the requirements of the service may be gathered from the fact of Sir W. Armstrong's constant endeavours with the shunt and other faulty modes of grooving to fire a non-leaded projectile, as well as from his attempt to provide a peculiar gun for the navy. Indeed, the adoption of the leaded shot has occasioned much difficulty and expense, and necessitated continuous alterations in guns, vent pieces, projectiles, powder, &c., and still no good Armstrong has been produced.

ARTILLERIST.

QUARTZ CRUSHING AT THE SYDNEY MINT.

NOT many months since the Legislative Assembly of New South Wales, voted £1,000 for the construction of an experimental quartz crushing machine, to be used at the colonial mint. Shortly afterwards steps were taken for carrying out the work, and since the departure of the December mail for England, the machine has been completed, and put successfully into operation. The general principle of the new quartz crushing machine, is the same as that of the Victorian province, with the addition, however, of an improved method of working the stampers. It has been designed and constructed in the Mint by the officers and mechanics of that establishment, under the superintendence of Mr. Trickett, of the coining department.

The castings for the machine were made by Mr. Dawson, and the fittings were prepared in the Mint workshops. The framework is of cast-iron, resting upon stone foundations raised about three feet above the ground, so as to give a sufficient fall to the amalgamators. The battery consists of four stampers, each weighing five cwt., and which are worked on a horizontal shaft by means of S-shaped cams and friction pulleys fixed to the stamp rods. The stampers thus acquire a rotary motion, and when in full operation, fall at the rate of eighty blows per minute. The place in which the stampers "play" is completely covered in; at the front and back on each side there is an escape, the opening being covered with fine wire gauze of 300 meshes to the square inch. A plentiful supply of water being kept up around the stampers, the action of these not only pulverizes the quartz, but splashes the tonic fluid mass through the escapes into small perforated troughs in front. Between these are two narrow ripple troughs, each containing about one inch in depth of mercury, with a board kept down to the surface of the mercury so as to bring the whole of the material into contact with it.

It is, perhaps, scarcely necessary to say that the use of the mercury is to extract the gold, the greater portion of which is taken up by it. The material, on leaving the mercury troughs, passes over a succession of four sloping tables, each about two and a half feet long, and covered with copper plates coated with mercury. The use of these latter is to take up any gold that passes. At the end of the four sloping tables there is another mercury trough, and below this again, another for the purpose of catching any waste mercury that may wash over.

Beyond all these is a gutter leading to two catch pits, and in these the "tailings" settle down; after each operation these tailings are taken out, and a sample of each assayed. As has been stated, the principal portion is taken up by the mercury and forms an amalgam. To separate afterwards the gold from the mercury, the amalgam is squeezed through chamois leather, the quicksilver passing readily through the pores of the leather leaves most of the gold behind in the form of an amalgam. This latter, still containing mercury, is submitted to an evaporative process which effectually disposes of the mercury. The gold caught by the sloping boards and by the lower mercury troughs is afterwards collected and treated as above. The whole of the mercury used in these operations is drawn off into a large iron vessel, and well mixed by stirring. Samples are then taken upon which assays are made, to determine the amount of gold still remaining in the mercury. By these means the possibility of error arising from defects in the chamois leather or from other losses is guarded against.

The new Mint quartz crushing machine is intended to be used for the purpose of experimenting upon quantities of quartz sent to be tested, not of actually developing the mineral treasure of the reef. There would not probably be much requirement in Sydney for a machine for this latter purpose, as it would never pay to send quartz in large quantities from any of the gold fields to the Mint. It would be far more wise, and far more profitable to take the machine to the reef, than bring the reef to the machine. Accordingly, the quantities of auriferous quartz received at the Sydney Mint for examination are limited to two tons. The charge made for extracting the gold by the processes above described, is, for quantities not exceeding one ton, £3 3s.; above one ton, and not exceeding two, £4 4s. There is also a charge for the analyses of tailings, where they are required to be made. There is no doubt about the machine being a valuable adjunct to the Australian Mint, or of its reflecting credit upon those to whom its construction has been confided.

PETROLEUM.

NOTHING has given us more satisfaction for some months past than to record from time to time the additional sources of petroleum which have been discovered in Canada and elsewhere. It appears after all that the importation and distribution of this substance in this country is not an unmixed blessing. Petroleum cannot be transported, bonded, and handled, unaccompanied with danger. On Friday last a deputation from some of the principal fire insurance companies in the metropolis waited, by appointment, upon the Lord Mayor, at the Justice-room of the Mansion-house, with the view of bringing under his notice this subject. The gentlemen composing the deputation were Mr. Lovell, secretary of the Phœnix; Mr. Sidney J. Fletcher, secretary of the Sun; Mr. Thomas B. Bateman, representing the London; Mr. John B. Johnston, secretary to the Royal; and Mr. John Atkins, of the Liverpool and London Fire and Life Insurance Companies. Mr. Lovell said they had sought the interview to call particular attention to this new product, which was being very largely imported into this country, and particularly the metropolis, which was likely to be still more largely imported, and which contained an element of danger unknown to any other substance. Petroleum was in the highest degree combustible, and threw off an inflammable explosive vapour at ordinary temperature, and even at a very low temperature. On Thursday, which was a cold wet day, it ignited on a light being held to it an inch from the surface. It floated upon, and would not mix with, water, and therefore water would not extinguish it. It was exceedingly volatile, and spread rapidly over the surface of water, burning fiercely when ignited. From statistics in possession of the fire-offices, it appeared that there were now lying at one wharf alone on the Thames, 7,000 casks, containing 210,000 gallons of this extremely inflammable oil; at another place 3,000 barrels, each barrel containing 46 gallons. These had been landed from one single ship, and if any fire should approach this mass of inflammable and explosive fluid, shipping on the river and property along its banks and in the docks would be placed in jeopardy, and the most disastrous results might occur.

Mr. Lovell said the deputation had taken the opinions of Dr. Lethehy, Mr. Miller, of King's College, and Mr. Warrington, of Apothecaries'-hall, with regard to the substance in question. Dr. Lethehy reported to them that:—"The raw petroleum gives off inflammable vapour at ordinary temperature, and this is explosive when mixed with atmospheric air, and will fire at a distance of an inch and a half from the surface of the liquid. The specific gravity of the liquid is 808·6, water being 1,000, and it boils at 212, rising to 266 of Fahrenheit." Mr. Miller stated that,—"The brown sample labelled 'crude' when poured into a shallow dish, of a temperature of 60 Fahrenheit, takes fire on the approach of a light, the vapour taking fire at an inch or more from the surface of the liquid. This crude oil is somewhat lighter than water, and consequently floats upon it. When poured upon water at 60°, it takes fire on the approach of a light to within about an inch of the surface and burns with great violence. If a teaspoonful of the oil be poured upon a saucer full of water five inches across, on setting fire to it the heat evolved as it burns is sufficient to make th water boil briskly at the surface. I have no hesitation in saying that I do consider such storage in the highest degree dangerous for the causes above-mentioned, and I think that stringent measures should be at once taken to prevent it." Again, Mr. Warrington reported that:—" Raw petroleum has a specific gravity 812 and gives off inflammable vapour continuously at the ordinary temperature of the atmosphere—58 to 60°. In these experiments the lighted match was held about half an inch above the surface of the liquid under trial. As both fluids are lighter than water, and are not mixable with it, they will necessarily float upon its surface without any modification of their properties." Mr. Lovell added, that about a quarter of a million of gallons was stored in the Isle of Dogs in the crude state, which, as had been shown, was highly inflammable. Mr. Lovell enquired of the Lord Mayor whether he could not interfere in the matter. The Lord Mayor said, as chairman of the Board of Conservators of the Thames he had no judicial functions, but as chief magistrate of the city of London, if they brought before him a case where there was any great quantity of this material deposited within his jurisdiction, it would probably be competent for him to interfere in the public interest, because there could be no doubt whatever, if what Mr. Lovell had said was an accurate representation of the facts, that the knowledge of such great quantities of inflammable matter being stored in any particular place would naturally excite terror in the minds of the people whenever the circumstance became known, and that on the authority of Lord Campbell in "the Queen v. Lister and Biggs" (Crown Cases Reserved), the law would justify a prosecution. It appeared to him that some law might be enacted, prohibiting its being accumulated together in large quantities in casks, and generally regulating its care and stowage. The storing of gunpowder, materials for fireworks and the like, except under particular conditions and at certain prescribed distances from inhabited places, was especially prohibited by statute; and although petroleum, being until recently an unknown substance, could not be included within the prohibition, yet, as he was advised, the common law would interpose, as in the case of naphtha, to prevent its being deposited in such quantities or in such circumstances as to endanger life or property. It seemed to him that it would not be desirable to put any law into execution, which might discourage the importation of this article. It appeared to be a gift of Nature, and we ought gladly to avail ourselves of its introduction; but it would be for the Legislature to regulate its introduction and use, accompanied as these were with a great element of danger.

ENAMELLED IRON TABLETS.

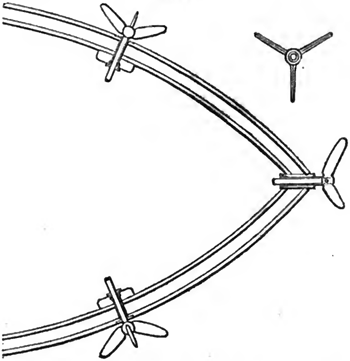
A short time since Mr. J. C. B. Salt, of Birmingham, patented a plan of enamelling iron or steel tablets. It consists of fusing upon a plate or surface of iron or steel a layer of enamel constituting a ground, and afterwards fixing upon the said ground the inscription or device in enamel of a different colour. The plate tablet is enamelled in the usual way, and by means of stencil plates the inscription or device is produced; the enamel used for producing it is somewhat more fusible than that covering the plate or surface, and of a different colour. By the use of two or more stencil plates inscriptions or devices of two or more colours may be produced. After the inscription is stenciled upon the plate, the letter is sufficiently heated to fuse the inscription or device and fix it irremovably on the plate.

These tablets are made of wrough iron, rendered incorrodible by the patented process. The iron is first covered with a dark or blue ground of a beautiful vitreous enamel, proof against corrosion, and the letters or device also of enamel, are then put on, and the whole securely burnt. The following advantages are claimed, viz:—1st. Their remarkable conspicuousness and legibility. At night, when any other plate or mark, unless quite freshly painted is invisible, these will be seen at a glance. 2nd. Their durability. Being perfectly incorrodible they will (except from wilful damage) last as long in all probability as the building on which they are placed. 3rd. Their economical price. 4th. They require no cleaning, are not susceptible to tarnish, and will always remain the same.

The tablets are manufactured by the Patent Enamel Company, and the London agents are Messrs. James Hunt and Co., 86, High Holborn, W. C.

BRAXTON'S NEW MODE OF STEERING SHIPS.

Fig. 2.



BRAXTON'S NEW MODE OF STEERING SHIPS.

The accompanying diagrams illustrate a plan of steering vessels, projected and patented by Mr. C. G. Braxton, of Kingston, near Portsmouth. Fig. 1 shows in section the fore part of a ship, with a shaft from the engine-r m, passing through the stem, and fitted with a shifting paddle of three blades. This may be made to rotate either way, and thus to force the bow into any direction required.

Fig. 1.

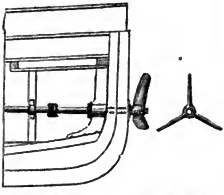


Fig. 2 represents the horizontal section of a frigate at the water line, showing a shaft and paddle at the stem, similar to that in Fig. 1. Two other paddles of the same form, are to work on shafts passing through each bow. These may be driven by a locomotive, or shafting from the main engines, as might be determined. The small diagrams show the edge view of the paddles, which would work always with two blades in the water whilst steering. When not in use, two blades on the contrary would be out of the water, and the third stand perpendicular, so that no impediment would be offered to the ship's progress.

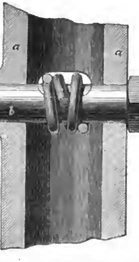
The arrangement shown in Fig. 1 would undoubtedly answer the purpose of steering under ordinary circumstances alone, and especially if the ship were going fast through the water, but as there has been great difficulty experienced in getting the very large ships about, Mr. Braxton proposes to add the paddles, shown in Fig. 2, to such vessels. He intends that the shafts should pass through stuffing boxes in the hull and that a simple means of attaching and detaching the paddles or screws, should be adopted. Spare paddles in any quantity might be had in reserve, and kept in small compass on board the ship.

Mr. Braxton further suggests that in large ships the shaft, shown in Fig. 1, should run the whole length fore and aft under the beams amidships. The shaft might then be made available for a variety of other purposes, as heaving the anchor, hoisting the screw-propeller, pumping the ship, hoisting the topmasts and yards, swinging guns, &c., &c., and in short superseding that nuisance the capstan. The men would thus be released from drudgery, which the engine would henceforth do, and be ready for working guns, for which operation there would thus be more room.

At present steam rams appear to be in favour with the "authorities," but if rams cannot, as experience at present demonstrates, be steered with precision, small vessels will not only escape from them, but quickly get under their sterns, and by a few shots aimed at their rudder posts cripple them effectually. It is satisfactory to find practical men like Mr. Braxton explaining their plans and views on the question of steering, for out of the discussions arising therefrom truth is sure to be eliminated.

Some very interesting experiments in relation to submarine warfare, proposed by Mr. Lancaster, have recently taken place at Shoeburyness, under the superintendence of the select committee. At the present moment we do not feel called on additional information, other than that it it may greatly influence the naval war future.

POTTER'S APPARATUS FOR STRAINING WIRES.

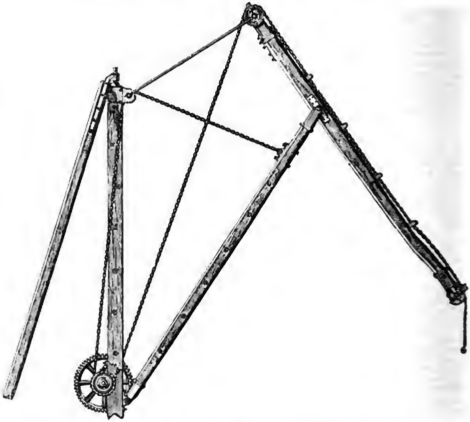


This invention, by Mr. J. Potter, of the firm of H. J. Morton and Co., Leeds, relates to an improved mode of constructing posts, or pillars, which may be formed either of wrought, or cast iron. The pillars or posts *a*, are tubular, so as to contain the roller *b*, of the straining apparatus hereafter described, and as represented in the above engraving. The spindles of these rollers pass through holes in one side of the pillar, or post, and have square ends, so that they may be turned on their axes by means of a winch key. The other end of the roller is inserted in a socket which is screwed, or pinned on to the other side of the post; an opening is cut in the front of the pillar or post, to allow the wire, or straud, to be attached or adapted to the roller; by inserting a transverse pin *i*, through the socket and roller, the latter may be held secure. When it is required to strain, or tighten the strands or wire the pin must be withdrawn, and then the roller may be turned half round on its axis, or made to perform one, two, or more revolutions, as the case may require; the pin is then to be reinstated in its place, and all will be again secure.

A NEW IRON-CLAD SHIP.

Messrs. Cramp and Son, of Philadelphia, are building a new iron-clad ship, a short description of which will be acceptable to our readers. She is 245 feet long, 57 feet 6 inches beam, and 25 feet hold. She has two floor timbers to each frame, each 40 feet long, 18 inches deep. and 13 inches thick; the balance of the frame is 10 inches thick, and tapers from 17½ inches at the floor head to 7 inches at the plank sheer. The spaces between the frames are fitted in solid from the keel to the plank-sheer, and she is caulked inside and out before the plank is put on. She has eight courses of keelsons 20 inches deep and 14 inches thick, besides the main keelson, which is 20 inches deep and 18 inches sided. This keelson has two 1½-inch copper bolts to each frame, fastened through frame and keel, making over 200 copper bolts 4 feet 6 inches long and 1½ inches thick for the main keelson alone. The berth deck clamps and bilge streaks are 9 inches in thickness. The gundeck clamps are 8 inches in thickness, and those on the spar deck are 7 inches thick. On each side of the keel are three courses of garboard streaks, and the planking on the flat of the bottom is 5 inches thick, gradually increasing in thickness from the turn of the bilge to the iron plating, where it is 9 inches. The iron plating will extend the whole length of the ship 4 feet below the water and 3 feet above, and for 180 feet amidships will be carried up to the plank sheer. The average thickness of the timber behind this plating will be 21 inches. The spar deck will be covered fore and aft with 1 inch iron plates before the deck plank is put on. In order to prevent any violent rolling of the vessel at sea, there will be three courses of the planking on each bilge projecting outside of the bottom planking 10 inches. The ship will be provided with extra steering apparatus so arranged that she can be worked without the rudder if necessary. The weight of the hull of this ship will be 1,970 tons, the iron plating 820 tons, and the total weight, including outfits, machinery, fuel, &c., will be about 3,880 tons, and notwithstanding this weight, her draft of water will not exceed 15 feet when ready for sea. The machinery for this vessel is being constructed by Messrs. Merrick and Sons.

BARCLAY'S IMPROVED CRANE.



The above engraving represents an arrangement of constructing cranes, for raising and lowering weights, the invention of Mr Barclay, of Kilmarnock. It consists of a main pillar or column fitted in a footstep bearing, and moveable or not about its axis. This pillar has jointed to it a jib extending upwards in an angular direction, and having jointed to its free extremity a secondary jib or beam, which sustains the load to be raised or otherwise moved. This secondary jib or beam is jointed to the main jib at about one-third of its length from the upper extremity, which is connected to the main pillar by a connecting rod or radius bar. A pulley is fitted to the lower end of the secondary beam, over this the chain to which the load is attached is carried; this chain is carried up over a pulley at the junction of the secondary beam and the radius bar, and down to an ordinary winding barrel, which is fitted to the main pillar, and may be actuated either by hand or steam power. The hoisting chain is wound round the front of the barrel, and there is a second chain for drawing in the main jib, which is wound on a duplex barrel in a direction contrary to that of the hoisting chain. The free end of this second chain is attached to the upper end of the jib, where it is jointed to the secondary beam. The winding barrel on which the hoisting chain is wound is made with a second barrel, which runs loosely upon it, but is caused to rotate with the primary barrel by means of a clutch, which is actuated by a hand lever. To raise the load the primary barrel is put in motion, then if the second barrel is put into gear, the main jib is quickly drawn in, and the load moves inwards in a horizontal line, in readiness to be at once deposited on the truck, waggon, or other receptacle placed in readiness to receive it. The clutch which throws the secondary barrel into or out of gear with the primary barrel is arranged with an annular ratchet wheel and spring pall, as well as the ordinary external wheel and pall, so that if the barrel should be inadvertantly put in motion the wrong way, the pall slips over the ratchet teeth without doing any injury, or causing breakage of the parts. In this way the cargoes of vessels may be very quickly transferred from the hold to an adjoining wharf. Or the movement of the jib may be reversed, so as to load the vessel with equal facility and economy of time. The arrangement of the crane is particularly adapted for loading and unloading vessels, as the free extremity of the secondary jib points in a downward direction, and its motion is in a horizontal line, the crane whilst working cannot in any way interfere with the rigging or sails of the vessel. The apparatus may also be used in situations where the ordinary cranes or derricks, which require a circular swing to move the load in a horizontal line, would be inadmissible.

PROCEEDINGS OF THE BALLOON COMMITTEE OF THE BRITISH ASSOCIATION.

At the meeting of the British Association at Manchester last year, a resolution was passed appointing the following members of the Royal Society a balloon committee:—Colonel Sykes, M.P. (chairman), the Right Hon. Lord Wrottesley, Sir David Brewster, Sir J. Herschell, General Sabine, Dr. Lloyd, Admrial Fitzroy, Dr. Lee, Dr. Robinson, Mr. Glaisher, Professor, Airy, Mr. Gassiot, Dr. Tyndall, and Professor W. A. Miller. £200 was placed at the committee's disposal, to enable them to carry out their experiments. This sum the committee propose to expend in making four ascents, two in the present month, and two later in the year. At a meeting of the committee, held last week; it was resolved that the first two ascents should be made from Wolverhampton—the first on Saturday, and the second on Monday or Tuesday. The balloon, with a complete apparatus for taking the required meteorological observations, was delivered at Wolverhampton on Friday evening. Lord Wrottesley made the necessary arrangements with the Wolverhampton Gas Company for a supply of gas, and in the evening Colonel Sykes (the chairman of the committee), Dr. Lee, Mr. James Glashier, the superintendent of the magnectic and meteorological departments of the Royal Observatory, Greenwich, and Mr. Henry Criswick, his assistant, all arrived in Wolverhamptan. The observations, it was arranged, should be intrusted to Mr. Criswick, who was to accompany Mr. Lythegoe the aeronaut. At noon on Saturday the members of the committee were joined by Lord Wrottesley and Mr. W. Fairbairn. At twenty minutes to two the voyageurs ascended slowly and steadily, and amidst the plaudits of the company were wafted away upon a quiet breeze almost due north. After remaining for a few minutes at no great altitude, the balloon was lightened, and she gained a height of, it was estimated, nearly a mile. By this time she had met with a counter current, and in 13 minutes after her ascent she was lost sight of, sailing in a somewhat westerly direction.

The objects sought to be obtained are twofold. First, to ascertain the law of decrease of temperature in proportion to elevation; next, to determine the distribution of moisture throughout the atmosphere. Other atmospherical phenomena it was desired to be noticed, but to these two points the observer was to devote his attention. Numerous beautiful instruments by which to make observations were specially provided for the occasion upon the most approved principle.

Mr. Criswick returned to Wolverhampton at midnight. The balloon proved utterly unseaworthy. A height of not more than a mile could be obtained, and the machine came down from sheer inanition at a distance from Wolverhampton of not more than seven miles. The "Royal Normandy" had scarcely got fairly up before the gas was found to be escaping from innumerable old rents, and the objects of the committee were entirely frustrated.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41 Corporation-street, Manchester, on Tuesday, March 25th, 1862, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the last month there have been examined, 383 engines, 2 specially; 514 boilers, 10 specially, 8 internally, 51 thoroughly, and 445 externally, in which the following defects have been found:—Fracture, 11 (4 dangerous); corrosion, 28 (1 dangerous); safety valves out of order, 8; water gauges ditto, 15; pressure gauges ditto, 13; feed apparatus ditto, 2; blow-off cocks ditto, 56 (2 dangerous); fusible plugs ditto, 2; furnaces out of shape, 14 (5 dangerous). Total, 149 (12 dangerous). Boilers without glass water gauges, 17; without pressure gauges, 7; without blow-off cocks, 53; without back pressure valves 87; while a single boiler was found without any independent safety valve, having only the limited use of one in partnership with another boiler, the connection to which depended on the junction valve being open.

"An explosion of a most fatal character, resulting in the loss of no less than six lives, has happened during the past month; while another, which took place in the preceding one, in addition to the five referred to in the last Monthly Report, occurred to a locomotive boiler, in consequence of the plates being internally corroded to ¼th of an inch in thickness. Not one of these boilers, however, was under the inspection of this Association.

"In the first of the above cases the boiler was a vertical one, and had been at work for eight years. It was set so as to utilise the waste heat of one or more iron furnaces, the flames from which first surrounded its lower half, and then passed into a central internal-descending flue through openings in its side. Its outer shell was egg-ended in shape, the height being 21 feet 3 inches, the diameter 9 feet, and the thickness of the plates $\frac{7}{16}$ths. In the internal-descending flue the diameter was 4 feet 8 inches, and the thickness of the plates ⅜ths all over. The crown, which was attached to the flue by means of an angle-iron only ⅜ths of an inch thick, was formed by two plates, a seam of rivets running across the centre, and was stated to have been cambered about 4 inches, upon which—since it was not strengthened by any stays whatever—it entirely depended for stiffness and power to resist the downward strain tending to collapse. The boiler had been fitted with two safety-valves, loaded to about 50lbs. on the square inch, one of them a dead-weight valve, and both of very ample area, the diameter of each being 6 inches; also, there had been a self-acting alarm float, with other necessary gauges and feed apparatus.

"I examined the boiler the day after the explosion had happened, and found that it had flown upwards through the roof of the building, when, being caught with a strong north-east wind blowing at the time, it had been carried a considerable distance, and landed on an adjoining mould of earth. It is probable that, had there been less wind, it would have fallen on the building, and thereby not only have crashed in the roof and machinery in its fall, but added considerably to the loss of life. As the explosion occurred just at daybreak, no reliable observations were made of its flight: but, from the chimneys it cleared in its course, it must evidently have soared to a considerable height.

"It is remarkable that five out of eight weights of flat disc, or cheese shape, with which the direct acting safety-valve had been loaded, retained their position on the boiler throughout its flight, although they had no other attachment to it than the stability afforded by the safety-valve as a base upon which they were piled. Judging from the position in which they lay they appear only to have broken away on the shock of the boiler coming to the ground.

"The cause of the explosion was apparent at a glance. The entire crown of the vertical-descending flue had been blown out, the angle-iron by which the crown was attached to the sides of the flue being rent at the root completely round the whole circle. The two circular seams of rivets in this angle-iron were both undisturbed; one retaining a part of it on the cylindrical sides of the flue, while the other held the remainder to the crown-plate, with which it was carried away entire.

"Evidence was adduced at the inquest to prove that the failure of this angle-iron resulted from overheating of the plates, consequent on shortness of water; the line of argument adopted being that no pressure the boiler could have sustained would have been sufficient to have shorn the angle-iron unless red hot, and experiments were instituted which were stated to prove that nothing less than a pressure of 1,260 lbs. on the square inch could have rent the boiler as it had been unless the plates had been heated from shortness of water. The jury brought in a verdict of manslaughter against the attendant, on the ground of negligence, and he was consequently committed for trial at the approaching assizes.

"I beg to differ most decidedly from the above evidence, and to take the following view of the failure of the angle-iron, which will be readily understood by those of our members who have watched the tendency of the front plate in their double-flued boilers to groove. The total pressure on the crown plate was about 50 tons, the whole of which had to be borne by this ⅜th angle iron, which was much too light for the duty. This load would vary with every alteration in the pressure of the steam, and be entirely removed when the boiler was at rest, and re-imposed when the steam was again got up. These constant variations of load would produce an alternating movement in the angle-iron, which would fret and rapidly deteriorate it, rendering fracture ultimately inevitable, and its occurrence merely a matter of time. It is to this cause, continued incessantly through eight years—the life of the boiler—that I attribute the failure of the angle-iron, and consequently the explosion, and not to shortness of water.

"I cannot doubt that an application of the hydraulic test would have detected this weakness in the angle-iron in time to have prevented the explosion, the occurrence of which affords an illustration of the hazard of trusting so much to a single angle-iron; and the fact of 99 having proved trustworthy is no gurantee that the hundredth may not fail, as in the present instance. It is always bad engineering to trust so much to a single thread, especially where loss of life may occur from its failure.

"It will be remembered that in the last Monthly Report it was stated that three boilers, working side by side, had been reported to have exploded simultaneously, the occurrence being attended with loss of life to the engineman. I have since then visited the scene of the explosion, and found the report a true one, while the injury caused to the surrounding property was beyond any I had before witnessed.

"These boilers had been of plain cylindrical egg-ended construction, fired underneath, and about 30 feet long, which, in addition to a Cornish one, with a single flue, had originally worked side by side, being all connected together. The latter being out of work at the time, escaped, or, from the injuries it received from the explosion of the others, would certainly have shared their fate. The egg-ended boilers had rent in the main, at the transverse seams, and the portions had flown more than a quarter of a-mile apart. One of these had alighted on a cottage, which it had seriously damaged; another into a reservoir; the egg-ends flying to the greatest distance, and smaller fragments falling nearer their original seat. The chimney, as well as a blast furnace, were brought down and reduced to a heap of ruins by one of the egg-ends in its flight; while a second furnace had the feeding gallery at its top dismantled. The roof of the adjoining engine-house was completely stripped of its covering, and the woodwork shifted bodily, breaking one of the engine beams by its movement. The original seatings of the boilers were reduced to an unintelligible heap, while bricks, and the *débris* generally, were scattered like grape-shot over the surrounding land in every direction. The Cornish boiler had been blown from the seat, and so strained by its fall that it had rent at the bottom of one of its transverse seams, as well as at the front plate at the junction of the furnace tube.

"The cause of the explosion was again attributed, as in the preceding instance, to shortness of water, consequent on the negligence of the attendant, who, it was supposed, had first allowed the plates to become overheated, and then suddenly admitted a rush of cold water. I carefully examined the parts, with a view of ascertaining how far this supposition was correct, but could not come to the conclusion that it was proved to be so. The supply of the feed to the boilers was found, on examination shortly after the explosion, to be cut off, which contradicted the supposition that a rush of cold water was let in immediately before its occurrence. Again, the engine had been at work for about a quarter of an hour, and had the explosion been caused by a sudden pressure of steam, generated by the dash of water upon heated plates, it would have taken place immediately on the starting of the engine. On consideration of the whole of the circumstances, which space forbids recounting in detail, I think it most probable that, in the first instance, one of the boilers rent over the fire, at a transverse seam, the treachery of which in these under-fired boilers is so common, and to instances of which the attention of the members has been called in the reports. Plain cylindrical boilers rending in this way always fly a great distance, as these had done, having time, while in the act of completing the rent from the bottom of the transverse seam, to take a sufficient angle of elevation both for the clearance of obstacles and the attainment of long range. The escape of water and steam from this opening at the bottom of the boiler would destroy the brick seating and blow up the sister ones, which, falling again on an irregular bed of loose brick, would become so strained as to rend, just as the empty Cornish boiler already described had done, and which in boilers having their steam up would be inevitably followed by explosion.

"I consider the above a further illustration of the inferiority of external to internal firing, and would point out that every one of the five explosions reported during the last month happened not to internally but to externally fired boilers, and am increasingly oppressed with the fact that this district has done wisely in selecting the Cornish type of boiler in preference to the plain cylindrical egg-ended one, and that, not only on the ground of efficiency and economy, upon which there can be no question, but also as regards safety."

HODGES' VOLUNTEER FIRE BRIGADE.

ON Monday last, March 24th, Mr. Frederick Hodges, the eminent distiller, of Lambeth, held a grand fete at his distillery, at which a very numerous and distinguished company assembled, including His Grace the Duke of Sutherland, the Earl of Caithness, Thomas Hankey, Esq., M.P., J. Harvey Lewis, M.P., Mr. J. E. Appold, C.E., Mr, Kitson (Mayor of Leeds), Mr. James Easton, Mr. Amos, Mr. James Anderton, of the West of England Fire Office, Mr. Charles B. King, M.E., Mr. Wellington Lee, Mr. William Roberts, Mr. William Baddeley, Captain Shaw, Captain Bent, &c.

Mr. Hodges' brigade, who were all in their full dress uniforms, first brought out their two powerful hand engines, which, when manned by eighty of the Grenadier Guards, performed some very creditable work.

The most novel feature in the programme was then introduced, in the shape of the celebrated American steam fire engine, manufactured by Messrs. Lee and Larned, of the Novelty Iron Works, New York. This engine was admirably worked by Mr. Lee and Mr. Charles B. King with the most satisfactory results. In seven minutes from the application of the match the engine commenced working, the pressure gauge indicating 5 lbs. of steam, which kept steadily increasing for seventeen minutes, when 140 lbs. was indicated, and under this pressure the engine threw a stream of water from a 1-inch nozzle to a vertical height of 145 feet, and a horizontal distance of 194 feet. Several different nozzles were tried with equally satisfactory results.

The next interesting feature was a trial of Bradbrook's respirator, which enables firemen and others to enter a smoky chamber without fear of suffocation. A shed had been prepared with wet straw, sulphur, assafoetida, &c., which, on being lighted, created a thick and pungent smoke. Mr. Hodges, Mr. C. B. King, Mr. Roberts, and Mr. J. Loader respectively wearing respirators firmly attached to their several breathing organs, entered the shed, which was intensely hot, and, by the means used, were enabled to stop in for various times from three to ten minutes.

In the evening Mr. Hodges entertained at a splendid dinner a select number of guests.

Through the permission of Mr. Hodges we will furnish our readers with a woodcut and full particulars of the steam-engine in our next impression.

MERRYWEATHER'S IMPROVED PUMPS.

FIG. 1.

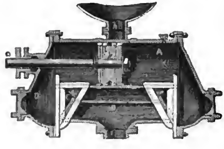
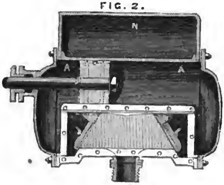


FIG. 2.



Messrs. M. and R. Merryweather, the well-known fire-engine makers, of Long Acre, have recently protected by letters patent improvements in pumps suitable for fire-engines.

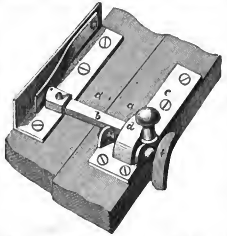
Fig. 1 is a sectional view of a horizontal double-acting pump constructed as above described.

A is the pump barrel, with two valve chambers *B*, divided by a partition attached to its under side, and communicating by means of the passages *D D*. The suction valves are situated in one chamber, and the delivery valves in the other. *G* is the piston rod working through a stuffing box; a passage *h*, on the outside of the pump barrel, forms a communication between the delivery valve chamber and the air vessel. *I* is the suction orifice; the delivery pipe is placed behind the suction pipe; the apertures in the passages are closed by screw plugs, through which access can readily be had to the valves in case of obstruction. *E E* are the suction valves; *K* is the cupped piston. formed double, with a cavity at *l* for holding oil, When the piston is at the extreme end of its stroke, the cavity *l* comes under an aperture, through which oil can be introduced, and the aperture then closed with a screw plug. As the piston moves backward and forward, the barrel is effectually lubricated by the oil in the cavity *l*. This pump may be worked by manual power applied to a lever or crank by steam or other power. The traverse of the piston is so arranged as to move the whole length of the barrel, by which means any dirt, grit, or other foreign substance that may be drawn up with the water will be effectually ejected at every stroke, and prevented from injuring the pump barrel.

Fig. 2 is a section of a horizontal double-acting pump, surrounded eccentrically (or otherwise) by a cylinder in communication with the delivery outlet, so as to form an air vessel.

A *A* is the pump barrel; *N* the surrounding cylinder, communicating with the delivery valves and outlet.

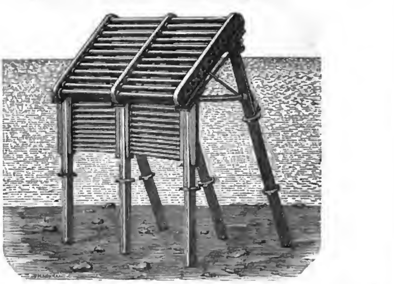
FARLAR'S IMPROVED SASH FASTENINGS.



The above engraving is a perspective view of an improved window fastening recently patented by Mr. W. Farlar, of Turnham Green. *a* is part of the bottom rail of the upper sash and *a'* is part of the top rail of the lower sash; *b* is the lever catch on the upper sash rail *a*; *c* is the locking plate on the lower sash rail *a'*; *d* is an arm through which a screw passes and along which it is free to travel. To secure the sash pull the lever catch *b* over the sash rail *a'* and beneath the arm *d*, turn the thumb piece *f* of the screw, when the sash bars *a* and *a'* will be drawn close together and the catch at the same time secured as shown. To loosen the fastening turn the screw in the reverse direction until the arm is clear of the catch stud.

Fastenings constructed according to this plan may be applied to sashes of any construction where fastenings are required, and also to dining tables and for other purposes where parts are required to be secured together and tightened at the same time.

WEBB'S IRON BREAKWATER.



WEBB'S IRON BREAKWATER.

In our number for February 1st, 1861, we gave a series of engravings illustrating an economical plan for constructing fixed breakwaters and piers for harbours. Mr. Webb, the inventor, has recently issued a pamphlet on the subject, which is well worth the perusal of persons interested in the building of harbours. The pamphlet exhibits the comparative cost of cast-iron over wood or stone jetties and piers, together with remarks as to the durability of cast-iron under sea water.

The plan proposed by Mr. Webb, consists of constructing such buildings of cast-iron pipes filled with concrete sunk into the ground by screwing or otherwise, and arranging them in the manner represented in the accompanying engraving. To connect the pipes, girders, or beams of iron, are placed, as a convenient distance, at ten feet apart but the distance can be varied in accordance with the locality. The girders have sockets, in which are fixed the ends of pipes forming that portion of the surface of the breakwater which rises above low-water mark. It will generally be found advantageous to place this surface at an inclination to the horizon. The pipes resemble gas or water mains, the ends are securely fixed in the sockets of the girders by creosoted wooden wedges; and these wedges, whilst keying up the ends of the pipes, relieve the girders from the effects which the blows of the waves, acting upon iron against iron, might otherwise produce. The spaces between the pipes admit a certain portion of the waves to pass through, diminishing the force of the blows of the waves, and preventing any disturbance of the surface-water inside the harbour. A set of similar pipes is fixed vertically between the piles in the front row to a depth varrying, according to circumstances, from six to twelve or more feet below low water.

On Saturday, April 5th, Mr. John M. Oubridge will read a paper before the *London Association of Foremen Engineers*, on "Cast Iron." The chair will be taken at 8 p.m.

Mr. William Ferrie has been nominated for the Inspectorship of Mines in the eastern district of Scotland, vacant by the death of Mr. Williams.

SCOTT'S BREECH-LOADING FIRE-ARMS.

The arrangement of breech-loading fire-arms as illustrated above, is the invention of Mr. Erskine Scott, of Windsor-place, Dundee. It is applicable to rifled and other small arms, and has for its object, by simple means, to combine increased facility in loading with security against the escape of any portion of the gases generated by the combustion of the powder otherwise than at the muzzle of the arm; and also to prevent the arm being accidentally or otherwise discharged when its several parts are not relatively in a suitable or safe position.

For these purposes the inner or breech end of the barrel is formed with or has attached to it three or any other convenient number of helicoidal inclines or cam lugs placed at intervals around its circumference, and the moveable breech-piece, which carries the nipple and receives the charge, is provided with a like number of corresponding inclines, capable of passing or being passed, when required, backward or forward between those formed upon or attached to the barrel, and of acting with them in the manner of a screw within its nut. At the inner or breech end of the barrel, around the bore, is a recess suitably formed to receive and constitute a gas-tight joint, with the frustum of a cone or other equivalent or suitable figure (or otherwise a combination of two or more such frustums or other equivalent or suitable figures) formed upon the corresponding end of the moveable breech-piece. To the moveable breech-piece, made as described, is jointed a tail-piece, which, when the breech is closed, extends backward towards the butt end of the stock, to which (the stock) its extremity may be secured by a screw, spring catch, or other convenient means. In order to load the arm, the fastening of the tail-piece, if any, is released, and the tail-piece is then turned up upon its hinge or joint so as to form a lever, whereby the breech-piece is then turned upon its axis, thus releasing its helicoidal inclines from those attached to the barrel, and enabling the former to be passed between the latter, and the breech-piece to be withdrawn. The act of turning the breech-piece upon its axis, as described, also removes the nipple from beneath the hammer. After loading, the breech-piece is pushed forward, so that its inclines are in advance of those of the barrel, when the act of turning the tail-piece into its former position causes the inclines of the breech-piece to act upon those of the barrel in the manner of a screw, as previously described, thus drawing the external or male conical part or parts of the one firmly into contact with the corresponding part or parts of the other, and thereby forming a gas-tight joint, which, when the male conical part or parts is or are on the breech-piece, the act of firing will tend to tighten rather than otherwise.

Fig. 1 represents a sectional elevation of so much of a gun as is necessary to shew the mode of application of the new arrangements; with the breech-chamber open ready to receive a charge. Fig. 2, is a similar view shewing the chamber closed, *a* represents a portion of the inner end of the barrel of a gun having screwed upon it the collar *b*, recessed, as shewn, to receive the breech-piece or chamber *c*. The collar *b* (an end view of which is shewn at Fig. 3) is let into and firmly secured to the stock *j* by screws, and is formed with the helicoidal inclines or cam lugs *d* placed at intervals around its circumference; and the breech-chamber *c*, which carries the nipple *f*, and receives the charge, is provided with a like number of corresponding inclines *g*, situated at the base of the conical part of the breech-piece, as shewn in Figs. 4 and 5, which are respectively an end and side elevation of the breech-piece detached from the stock. At the lower part of the breech-piece *c* is formed a ⊥-shaped projection *h*, capable of sliding in a suitable groove or slot formed in a plate *i*, Fig. 6, let into the stock *j* of the gun. To the breech-piece *c* is jointed the tail piece *k*, which, when it is required to load the arm, is lifted up, and then constitutes a lever, whereby the breech-piece may be caused to partly revolve upon the line of its axis, and the cam lugs *g* formed with the breech-piece be thus removed out of contact with those marked *d*, formed with the collar *b*, and brought opposite to the intervals or spaces between them, when the breech-piece may be drawn backward out of contact with the collar *b*, and thrown over slightly toward the left-hand. After loading, the breech-piece is pushed forward, and its conical end is, by means of the tail-piece *k* and inclines *g*, again tightened against the corresponding conical recess, situated at the inner end of the barrel.

In order to admit of adjustment to compensate for the wear of the helicoidal inclines, the conical recess into and against which the end of the breech-piece fits, instead of being formed in the end of the barrel itself, is formed in a separate collar or washer *l*, which abuts partly against a shoulder *m* formed in the collar *b*, and partly against the inner end of the borrel *a*. When the faces of the inclines have become worn, so as to render adjustment necessary, the collar *l* must be removed and reinserted with a thin washer of metal or other material interposed between it and the face (formed by the shoulder *m* and end of the barrel) against which it rests. A small groove formed in the loose collar or washer *l*, and a pin fixed in the outer collar, as shewn, guide the former into its proper position when it is returned to its place.

SCOTT'S BREECH-LOADING FIRE-ARMS.

FIG. 1.

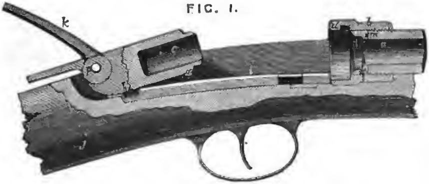


FIG. 2.

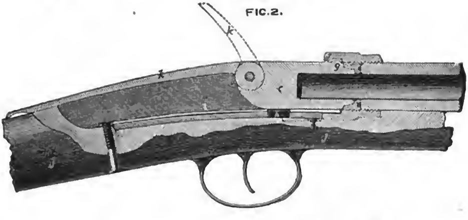


FIG. 6.

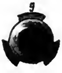


FIG. 4.

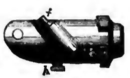


FIG. 3.

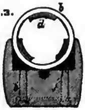
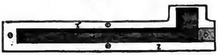


FIG. 5.



Telegraphic Intelligence.

RED SEA AND INDIA TELEGRAPH.

The expedition of the Telegraph to India Company (says the *Times*) which left this country about two months since for the purpose of repairing such portions of the Red Sea cable as are not too far gone in dilapidation is, it appears from recent advices, progressing very favourably with the work, and it is hoped that before long some of the most important sections will be open to the public. It may be remembered that at the period of the failure of the Red Sea lines some sections were reported to be in comparatively good condition, and it is these portions which Mr. Latimer Clark and his electrical and engineering staff are now endeavouring to restore. This however, is only one of the objects of the expedition, for so disastrous has been the experience of submarine wires in the Red Sea that it is the intention of Sir C. T. Bright and Mr. Clark, the engineers of the company, to do away with a large portion of the sea route altogether, by carrying a land line through Upper Egypt and Nubia along the banks of the Nile, and thence crossing an arm of the Desert (about 90 miles broad) which separates the Nile Valley from the shores of the Red Sea. Mr. Latimer Clark's applications to the Pasha of Egypt to give this scheme his countenance and protection have been entirely successful, and as the Pasha himself has a telegraph up the Nile for nearly 700 miles of the proposed route, there seems no doubt but that this most important link in the line to india will soon be completed.

With a view to insure the wires being thoroughly and efficiently protected throughout, Mr. Clark, with Mr. Rolfe and several of the Pasha's officers, has been up the Nile to arrange with the Sheiks of the different tribes through which the line will pass. The conference with the Sheiks was most successful, and they are now all pledged to the protection of the wires. As they have previously been employed by the Viceroy, with great success, in looking after his telegraph, there is no reason to doubt their ability or willingness to do so in the case of the Indian line, especially as they are to be paid for it, and there is no inducement to a Bedouin like a promise of "backsheesh." In the meantime, other portions of the expedition have been dispatched to examine and report upon that section of the Cosseir and Suez line that extends as far as the Island of Shadewan, at the entrance of the Straits of Jubal. This portion, from tests taken by Mr. Laws, was supposed to be, if not absolutely perfect, at least in sufficiently good order to be capable of being worked for a considerable time.

To complete the repairs of this section, therefore, Mr. Laws, with Mr. Brunton and Mr. Woods, was sent in the Egyptian steam sloop Gabari with a strong working electrical and engineering staff, to carry the line as far as Jubal, and open a temporary station there to intercept and forward messages from the Indian mail steamer. The Gabari arrived at the scene of operations on the 14th of February, when a very cursory examination was sufficient to show that the bottom was of the most unfavourable kind for grappling a cable, as coral reefs abounded on all sides. But before any operations could be undertaken the rough weather which seems to wait upon all telegraph operations set in earnest, and the Gabari was obliged to retire to the doubtful shelter of the coral reefs to wait for an abatement of the gale. Ten days elapsed, however, before the weather moderated. On the morning of the 24th operations were renewed, and, after a few coats of the grapple, the line was hooked, but owing to its having been laid out quite tight it broke in hauling to the surface. A buoy to mark the spot was immediately let go, and soon after the end was brought on board from 57 fathoms water, and the lifeboat was sent to recover as much cable as would be sufficient to land the end on the Island of Jubal, about five miles distant.

The work having to be carried on entirely by manual labour, and without appliances of any kind, was necessarily slow and difficult, and at dusk the vessel had to be anchored and the end buoyed for the night. It had however, been sufficiently long on board to prove that for all practical working purposes the wire was in good order. So much has been said about the instability of submarine lines laid in comparatively shallow water that the raising of this was looked forward to with considerable interest; yet, when brought to the surface, even after having been subjected to the action of the waves over the coral rocks for three years, it was found to be but slightly altered in outward appearance.

A close examination showed that in some places the wires were corroded slightly, but still the black coating of mud and oxide with which it was covered so closely resembled tar that it seemed at the first glance impossible to believe that the wire had been down more than a few months. The Gabari then continued to underrun the line till within a mile and a half of Jubal Island, and the accounts state that it is difficult to imagine anything more beautiful than the mass of zoophytes, of every tint and colour, which had cased round the whole cable to the thickness of several inches. These being mostly of a soft tenacious nature would tend most materially to preserve the outside iron wires from decay. On the 26th the Gabari underran the shore end of the cable to Cosseir, in order to remove it and lay it to Jubal Island. Though the portion of this line had only been down some 14 months, yet it was found on raising to be completely encased in a protecting sheath of coral and zoophytes.

THE ATLANTIC TELEGRAPH COMPANY.

The following is a description of the cable just submitted by Messrs. Glass, Elliot and Company, to the Atlantic Telegraph Company as the one they would propose to lay, and to a considerable extent to guarantee, as to working efficiency, between Ireland and Newfoundand, requiring a length of 1900 nautical miles.

The electrical conductor is composed of seven copper wires, each $\frac{1}{16}$ inch diameter and laid into a strand rendered perfectly solid by the six outer wires being embedded in Chatterton's Compound upon the centre wire. The conductor weighs 510 pounds per nautical mile, and is calculated to transmit under the *old* system of working 22 letters equal to 4½ words per minute, but is certified by Mr. C. F. Varley to be capable of being worked by means of recent improvements at the rate of 60 letters, or 12 words per minute, between Ireland and Newfoundland.

The conductor is insulated by eight coatings, four of the purest gutta percha, and four of Chatterton's compound, laid on in alternate layers, forming together a thickness of $\frac{5}{16}$ of an inch from the centre; the external diameter of the whole cable being $\frac{9}{12}$ of an inch, weighing with conductor 1060 pounds per nautical mile.

It is proposed to do away with the tarred hemp hitherto surrounding telegraphic cores, and as a protection to the core, to use strands consisting each of three best charcoal iron wires, gauge, ·066 each strand being separately covered with Chatterton's compound and gutta percha to prevent decay. These coated strands, thirteen in number, are then laid around the core spirally by the usual machinery, and the finished cable passes out of the covering machine into tanks filled with water, there to wait till the whole length required is ready for shipment, water tanks will also be provided on board ships so that from the very infancy of the cable to its final submersion, it will be continuously every moment under tests of the most certain and delicate description.

The dispensing with the tarred yarn hitherto in use, renders the instant detection of any flaw in the gutta-percha core, an absolute certainty. These were often temporalily concealed by the wrapping of tar which is to some extent an insulator, and only broke out after the cable had been laid and worked through for some short period. Every part of the external surface of the cable being thus also of a nature quite indestructible in and impervious to water, there is no, fear of deterioration either before or after submersion and none of the original strength being lost by decay' it would be possible to lift this cable if required even from very deep water.

SOIREE AT MR. S. GURNEY'S.

On Wednesday 'evening last Mr. Samuel Gurney and Mrs. Gurney, gave a soiree at their residence, Prince's Gate, Hyde Park, in connection with the project for uniting England and America by electric telegraph between Ireland and Newfoundland. During the evening telegraphic communications were interchanged between Mr. Gurney's house and the principal continental cities, and the whole proceedings were of a very interesting character. The company included Mr. Varley, Mr. Gurney Barclay, Mr. Cyrus W. Field, Sir Cresswell Cresswell, Mr. and Mrs. Savill, Dr. Stephenson, Mr. Gerrard Cresswell, Mrs. Cresswell, Chevalier Bonelli, Mr. Lightly Simpson, Lord and Lady Robert Churchill and Miss Alderson, Mr. J. W. Brett, Mr. Chatterton, Dr. Wallich, Chevalier and Madame de Bunsen, Alderman Rose, Mr. Cropsey, the Earl and Countess of Shaftesbury, Lady Victoria Ashley, Sir Thos. Trowbridge, Mr. Austin, Professor Wheatstone, Mr. Lefroy, M.P., Mr. Curtoys. Mr. E. Egerton, M.P., Mr. W. H. Stevenson, Mr. E. Gurney, Sir C. Bright, Captain C. L. Peel, Mr. George Godwin, Mr. Moran, Mr. Peter Coates, Mr. Dyer, Hon. E. Ashley, Professor Rogers, Mr. Glass, Mr. Scamuel, Mr. C. Pelly, the Right Hon. Stuart Wortley and Mrs. Wortley, Mr. Robert Taylor, Mr. Bevan, Mr. and Mrs. Thomas A. Hankey, Mr. Crum Ewing, M.P., the Marquis D'Azeglio (Italian Minister), Mr. H. F. Barclay, Lord Alfred Churchill, Mr. Schenley, Mr. and Mrs. Gurney Hoare, Captain Du Cane, Mr. H. Pease, M.P., Mr. Fry, Mr. Whitehouse, Mr. Cassell, Mr. Lampson, Countess of Gainsborough and Lady Victoria Noel, Duke of Somerset, General Wylde, Dr. and Mrs. Prothero Smith, Dr. King, Mr. Morgan, Lord and Lady Monteagle and Miss Marshall, Mr. Gisborne, Bishop of Ohio, Hon. and Rev. B. Noel and Miss Noel, Mr. Willson, Colonel Cavan, Mr. E. Clarke, Mr. Passmore Edwards, Mr. T. Brassey, Mr. Henry Ford Barclay, Mr. George Saward, Mr. Branscombe, Sir Culling and Miss Eardley, Dr. and Mrs. Lushington, Hon. A. Kinnaird, M.P., Mr. Robert Hanbury, M.P., Mr. Hubbard, M.P., Mr. Charles Buxton, M.P., and Mrs. C. Buxton, Sir Fowell Buxton, Monsieur Musurus Bey, Mr. F. Barclay, the Hon. Gerald Noel, United States Minister, and Mrs. Adams, Mr. and Mrs. Charles Reynolds, Sir Emerson Tennant, Bart., Mr. T. A. Massey, Mr. Kersting, Mr. Gutteris.

Mr. Jeffery's rifle 32-pounder service gun, one of the competition series, has burst in the proof cell at Woolwich. We believe it has fired about 300 rounds.

TO CORRESPONDENTS.

Received.—G. and R. W. H., R. O. B., Captain N., H. A. W. B., R. A., E. S., Mr. W., R. G., Captain N., J. H. S. (next week), A. W. B., B. and M., W. B. for E. S., M. A. S., G. W., G. S., Mrs. de B., G. C., F. J., J. T. W., W. W., F. A. F. (see another letter on the same subject in this number of the M.M.), J. N., W. B.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

ATLANTIC TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I beg permission to make a few remarks upon a lecture delivered by Mr. J. E. Davis, R.N., at the Mechanic's Institute, Plymouth, on the 15th instant, on "Telegraphic Communication with America," to which you gave publicity in your journal of last week under the title of "Ocean Telegraphy."

Mr. Davis complains that an American company obtained from the Newfoundland Government the sole right to establish telegraphs from that island and the adjacent coast of Labrador to the United States, and also the concession, to the exclusion of others, of landing wires on the coast. This is true, and the local act of Parliament conferring that privilege for fifty years, has been signed and approved at the Colonia Office in London.

But what has Mr. Davis's company done superior to this? They are not Danes, I believe; but so important did they conceive it to obtain some protection for their enterprise, that they have obtained from the Danish Government the monopoly of attempting to lay cables on the shores of Greenland, Iceland, and the Faroes, during *one hundred years!*

So much for exclusiveness!

Mr. Davis then goes on to make the following remarks:—"Seventy thousand pounds were paid for that permission by the English company, with a certain royalty to be paid on every message transmitted. There was also a stipulation as to time, so that if we wished to take another cable across, new and other subsidies would have to be paid to obtain permission to land, and *that* is what brings Mr. Field to this country;—he is chairman of the company that holds the concession, and is naturally anxious to finger another seventy thousand pounds of English money."

Now anything more shamefully mis-stated than this can hardly be conceived. The misrepresentations are the more unpardonable as every arrangement of the Atlantic Telegraph Company has been published over and over again, and its history recorded in public documents accessible to every one.

I will now state the entire connection of Mr. Field with the Atlantic Telegraph Company. Mr. Davis quietly assumes that the exclusive privileges of the New York and Newfoundland Company were given them by the legislature for nothing. This is a very great mistake. They had to erect all over the inhospitable country of Newfoundland a series of telegraphic communications, to connect that colony with Cape Breton and Nova Scotia by submarine and land lines, and to make roads in certain localities through Newfoundland; and in return for these works, as well as to encourage the telegraph to Ireland, the exclusive right of landing cables, and other privileges, were granted.

Having done what they were bound to do on the American side, the New York Company looked at the question of crossing the ocean by telegraph, and they then thought proper to place their exclusive rights in the hands of Mr. Field, to be dealt with so as to promote the object of establishing a telegraph from America to Europe in the best manner he might be able. They allowed him personally, at the same time, in consideration of his enormous labour, to retain to himself, or to deal as he thought proper with any profit that might accrue from the arrangements he might be able to make in respect to the oceanic line.

Mr. Field came to England in 1856. He associated with himself, as co-projectors and participaters in those assumed profits, three Englishmen—Mr. J. W. Brett, Mr. Wildman Whitehouse, and Sir Charles Bright. In due time, the Atlantic Telegraph Company was formed. Mr. Cyrus Field in starting it, took up, on his own account, 88 shares of one thousand pounds each. Upon all of these he paid into the coffers of the company, in cash, the first deposit of £17,600, and upon 67 of them he paid the entire amount of calls, amounting to £67,000. This I am in a position to verify. A great number of those have been sold at a loss; but Mr. Field is still the largest holder of sha s in the company paid up in cash.

It had been arranged that the projectors should receive no remuneration till the shareholders had first been paid 10 per cent. dividend. The directors did not, on reflection, like this arrangement, and wished to compromise it for an amount in shares to be credited as fully paid up; after discussion it was agreed to pay the four projectors £75,000 in these paid-up shares, but only *when the cable had been successfully laid!* When the cable had been laid and worked, these shares were issued to Mr. Field and his partners, Mr. Brett, Mr. Whitehouse, and Sir Charles Bright, and I can only say that from that day to this Mr. Field has never turned one of those shares into money, nor has he attempted to do so.

But let us here make a little enquiry. Does Mr. Davis, whose propriety is so shocked at the sale of a concession, does he, if he has a projector's share in the northern route concession; do Messrs. Croskey and Shaffner, and *their* co-partners, intend or desire to *give away* their concession, to offer up their labours and expenditure on the altar of the public good, for naught. The Atlantic Company have offered to give up their monopoly to the Government, in return for some assistance, are the northern party prepared to do the same without personal remuneration? I trow not.

Mr. Davis says that, in addition to the £75,000, which he wrongly assumes to have been paid in cash, a royalty is to be paid on every message transmitted. This is so far from being the truth, that Mr. Field has actually succeeded in making with the American Telegraph Company, an arrangement whereby *they* will make a *reduction in favour* of the Atlantic Company of 40 per cent. of their ordinary tariff upon all European messages passing over their lines.

Mr. Davis says that "if we wished to take another cable across now, another subsidy would have to be paid for permission to land, and that this is what brings Mr. Field to this country, he being anxious to finger another £70,000 of English money." These assertions are totally without the slightest foundation.

Mr. Field has crossed the Atlantic twenty-five times on behalf of the great enterprise to which he has vowed himself; he has laboured more than any other individual in this important cause, and he has never asked the Atlantic Telegraph Company for one shilling remuneration for his valuable services, which he was in no way bound to render them; nay more, when an offer of compensation was made to him, he refused it.

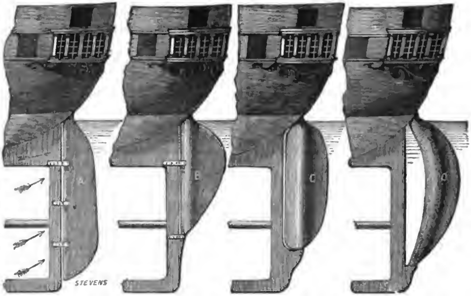
The concessions to land cables granted to the Atlantic Company in return for the £75,000 paid-up shares, are by virtue of that payment the absolute property of that company till 1868. If a cable be laid before that time they will be absolutely theirs till the end of the term of fifty years. But if misfortune prevent the company from succeeding before 1868, there is not a doubt but it will be renewed gratuitously for as long as may be needful. I pass by the greater part of the remainder of Mr. Davis's lecture, merely observing that his electrical disquisition upon Mr. Hearder's cable is not very valuable.

I also pass by his remarks upon the Greenland route, because while they are intended by Mr. Davis to be laudatory of that route, he is evidently reasoning wrong from right premises; the facts cited by him, and founded on his own experience, being its strongest condemnation, and leading to the inevitable conclusion that to attempt to lay cables along the line advocated by Mr. Davis would be a highly impolitic expenditure of capital.

I now come to Mr. Davis's statement that the route of the Atlantic Company will never pay. Upon this point I forward you herewith, the certificate of Mr. Allan, who undertakes that his cable will work between Ireland and Newfoundland at the rate of ten words per minute; of Mr. Varley, that a cable containing 510 pounds of copper and 550 pounds of gutta-percha per knot will work at twelve words per minute between the same places; and, of Mr. Fleeming Jenkin, that such a cable will work at the rate of eight words per minute. I have also seen a statement from Professor Wheatstone, that a cable submitted to him costing much less than the preceding, would work across the Atlantic at the rate of sixteen words per minute. Mr. Davis says that messages can be sent nine times quicker by the Arctic route than by that between Newfoundland and Ireland. Does he mean to say that his Greenland cables will transmit 144 words per minute? If so, they will do six times more work than even any ærial line of which I have had experience during the twelve years I have had to do with telegraphs.

Mr. Davis garbles an undertaking given to the Atlantic Company by the Gutta Percha Company, whose business has nothing whatever to do with *laying* cables, but who say if the contractor into whose hands their work passes after they have turned it out perfect, will lay the line in as good a state as they delivered it to him, they will be answerable for its working; but Mr. Davis omits to quote from the undertaking of Glass & Co., the very contractors who offer to lay the cable, who say that so satisfied are they of its practicability and commercial value that they are willing to risk a very considerable sum upon that event.

CAPTAIN SKINNER'S METHOD OF STEERING SHIPS OF WAR.



Mr. Davis says that "contractors are to be found to take the responsibility of laying and working the Northern line, and that at a less cost than the direct route." Will he kindly favour the public with their names, that their experience and responsibility may be fairly judged of?

In conclusion, I will merely remark, that if the interests of the Northern route can only be advanced by garbled quotations and coarse personal calumny, it has but poor props to rest upon.

Yours, George Saward.

22 Old Broad Street, 26 March, 1862.

◆

"STEERING SHIPS OF WAR."

Sir,—I have read with much interest Mr. Moy's letter in your paper of the 7th of March, headed, "Steering ships of war." The subject is of great importance, and respecting which there is yet much to learn, more particularly as I perceive from remarks made in your paper from time to time that steering by a rudder at the stern is considered by some likely to be superseded. I do not myself think this likely, so far as sea-going vessels are concerned, but feel quite certain that the present rudder may be greatly improved on. It is said in the letter alluded to that $\frac{1}{15}$th of the length between the perpendiculars was considered in former days the proper breadth of rudder. It is, I think, fortunate that such is not considered right in these days, else our present 60 gun frigates would have upwards of 12 feet breadth, which no rudder-head could stand against, under the present system of hanging the rudder. Respecting the run of water bearing on the rudder; I am inclined to think, secondly, that very erroneous ideas exist; the general belief being that the water runs towards the rudder in straight lines horizontally, acts with greater force at the keel than at the water line, and consequently the rudder should be of equal breadth up and down. Now, I believe that the current, or rather currents of water do not run towards the rudder horizontally except at the water line, but rush up in curves from below to fill the vacuum caused by the vessel's passage through the water, and therefore, the extreme breadth of the rudder should be at the line where these currents unite, viz., at the water line; as however sea-going vessels are apt to be struck at that spot by heavy following seas, the extreme breadth should be placed below the water line, in order to prevent injury, and as shewn in the accompanying sketch. It amounts almost to a certainty in my mind that the lower portion of rudder might be altogether dispensed with; or it will be found that in almost every shipbuilder's yard there is some record or remembrance of vessels which have had the heels of their rudders knocked off, and yet steered as well as ever, if not better than before the accident, certainly easier; in consequence of so much extra strain having been taken from the rudder head. The bad steering of tha Warrior may, I think, proceed from her not having a keel, as well as from not been able to give sufficient angle to her rudder; and it was to have been expected that a flat floored vessel, no matter how long she might be, would, with the wind free a following sea, and no keel, yaw about in spite of her rudder.

Mr. Moy very properly suggests that where well-holes do not exist the rudder head should enter below the water line, and I would add to that, that the rudder should not go lower than the screw shaft, all below that point only assisting to strain the rudder head, and not adding to the steering power.

I send sketches of four rudders as under, A, B, C, D, and remain faithfully, A. W. Skinner,
Captain, R.N.

A, rudder, as at present shaped.

B, rudder, as proposed by me (A.W.S.), also,

C, rudder, suspended by head and heel only—$\frac{1}{3}$ before the spindle $\frac{2}{3}$ abaft—and so relieving the *rudder's head.*

D, rudder, as I believe, proposed by *Mr. Moy* in his *letter.*

◆

A NEW GUN.

Sir,—An improvement in the mode of working guns for defending towns, superior to the one now in use, is much required, as explosions occurring in powder magazines and battery stores often cause their otherwise unnecessarry surrender; for instance, at St. Jean d'Acre, by Napier, and last year at Gaeta, where the materials accumulated for defence, proved to be the principal means of destruction, notwithstanding, it is to be presumed every possible care was taken. No man can dispose of his energies to good effect, when subject not only to an enemy's missiles, but the possible death of himself and surrounding comrades, through no error on his part, by an explosion of the materials carefully stored for use close to him. Science surely should be capable of relieving the defenders of towns from such trying ordeals as death confronting them from both sides. Permit me to suggest an alteration in the working of such guns in the direction of making them what they should be, destructive only to the besiegers. To obtain this the use of gunpowder requires to be discontinued, and the means employed should merely be subject to explode when desired inside guns. This proposition can be solved by mixing together inside guns, two or more agents which are unexplosive when separate, but powerful when combined; say, for instance, two different gases compressed together sufficiently to obtain the required explosive force, which might be effected by the following mode:—At any suitable spots erect underground small apparatus for generating and storing the desired gases, say carburetted hydrogen and oxygen gases (which on exploding would form carbonic acid and water), lay main pipes, also underground, with two different branches to convey the gases to every gun, their terminations having valves, also buried, having long rods for turning them at top; these valves to be connected to a gun by two lengths of strong wire-coiled flexible tubes, covered so as to be air-tight, each of which is to have a suitably proportioned cylinder fitted with piston and rod adapted for forcing a proper quantity of each gas through the respective tubes when desired. Previously to charging a gun with two compressed gases, forming when combined a powerful explosive compound on being fired, an elongated ball or shell should be placed therein, either through the breech or muzzle, so as to obtain a perfectly air-tight chamber inside the gun by covering the lateral sides of the ball with grease, which on being well set up would close the bore hermetically. By turning on the gas, all air in the compartment made would be ejected through the touch-hole. A percussion cap of extra length is desirable, in order that the end may enter deeply into a cup of grease surrounding the touch hole to seal this aperture. The charge of gases may now be forced to the necessary extent inside the gun, after which the second set of valves, firmly fixed in the under part of the gun, in connection with the gas tubes, should be turned off before firing. The flexibility and extra length of the tubes would allow for any recoiling or deviation of the gun.

Yours respectfully,
George Walcott, C.E.

March 21st, 1862.

◆

THE ALBERT OBELISK.

Sir,—It is desirable that the four corners of the proposed obelisk be placed parallel to the four cardinal points respectively—a condition which was, I think, attended to in the building of some of the Egyptian pyramids and obelisks.

The present state of scientific allegory is exceedingly low; indeed of allegory proper I do not think that a single example has appeared in modern time. All we have, is a figure with a globe and a compass or things of the kind, which is but a very poor—because apparently unsuggestive—device. I would not that we exactly return to the winged animals of the Egyptians; nor to their heiroglyphics, which are unintelligible, only because they are not understood, and which Swedenborg assumed that he *only* could explain, and this by the science of representations and correspondence, but never did—but I would that sculptors made use of lofty symbols, and did not arm their figures with the very *tools*, by the use of which the excellencies in question had been brought about. Let them get rid of the notion that every Newton must have a prism, and every Johnson a folio under one arm, and, in these cases, employ noble symbols, significative of the discovery of truth.

Yours, &c.,
J. Alexander Davies.

March 17, 1862.

◆

FRYER'S PROPELLER.

Sir,—I observe in your valuable journal of the 21st, that it is stated the principle of Mr. Fryer's propellers was patented by Mr. Rennie long since. If your readers will refer to No. 598 of the Mechanic's Magazine for 1835, page 280, they will find a letter from the indefatigable Colonel Maccrone, in which he states that in the year 1827, he presented a plan to the Duke of Clarence, which he thus describes: "I proposed to work my propellers directly from the piston rods of the engines by a simple connecting rod, and as low under water as possible. I constructed *a square frame of flat irons, with six or more flaps, which opened and shut like a venetian blind:* when such propellers consist of only two large flaps, part of the stroke is lost, from the time which it takes for the flaps to open."

We have here, I think, as near a description of Fryer's "Patent" propeller as given in your journal of the 7th of March, as need be, and I am nearly sure, though I cannot at the present moment call to mind, where, that I have seen a similar contrivance described many years before the Colonel.

In your journal of the 21st I also observe a plan of constructing armour-plates by "rivetting thin plates together," said to be a plan "proposed by Mr. Hawshaw." There is nothing new in this, as it was known and tried in the United States prior to 1850, and found, as any practical man would at once pronounce it, totally useless.

Your obedient, Y. Z.

London, March 22, 1862.

Gossip.

◆

Among the articles to be sent to the Exhibition from the island of Dominica, in the West Indies, are no less than 170 varieties of native woods, principally hard and susceptible of a fine polish. Indeed, the specimens of wood from our various colonies, manufactured and in the rough, will form to a large and influential body of the British community one of the most interesting sections of the palace of arts and industry.

Our indefatigable, if not particularly lucid and erudite correspondent, Mr. Davies, has taken some exceptions to our strictures on the Exhibition building; but singularly enough, he bases those exceptions on mistaken premises, and therefore they fall to the ground without being shaken. If the building were not a *temporary* one, he says, our criticisms upon its extreme plainness would be justifiable. It is only necessary for us to state, what probably every one beside Mr. Davies is aware of, namely that the edifice is to be *permanent*, in order to put our correspondent, in *legal* parlance, "out of court."

In a cavity below the foundation stone of the Albert Mausoleum at Frogmore were deposited a complete set of the current coins of the realm, bearing the date of 1862.

A correspondent suggests—and the idea certainly has novelty to recommend it—that, instead of erecting a granite obelisk in commemoration of the Prince Consort, one of *glass* should be reared. It might be formed "in stiles or panels of plate-glass some two inches in thickness, and be so cut and ornamented as to display from all points the prismatic colours, and thus become an imperishable and beautiful object." It might, moreover, he thinks, be made of such dimensions as to contain the same weight of "crystal" as was used in the Palace of 1851. The difficulty in the way of carrying out our correspondent's views would, we fear, be found in producing a casting—if one only is to be employed—of sufficient size and purity; or if more than one, in attaching them to each other by invisible jointings, which would be a *sine qua non.*

Many attempts have been made to effect type setting by mechanical means. They have, however, been successful to only a limited extent. The principal characters have been put in well enough, but the rest had to be set up by hand. Mr. Felt, of Massachusetts, U. S., has now, it is said, overcome the practical difficulties hitherto standing in the way, and has brought out a perfect machine. Felt's type setting machine contains not only all the characters which may be desired, but due proportions of such as Q, X, and Z, which are of rare occurrence. It has also the means of "justifying," and it *reads bad manuscript*—the worse the better!

Some very simple but valuable practical hints for the preservation of pictures have recently been promulgated by the Belgian Minister of the Interior, and we commend them to the notice of the Commissioners of the International Exhibition, and others who may have the custody of valuable paintings. In the first place, the greatest enemy to pictures, damp, is referred to. In order to ward off its attacks it is recommended that "air should always be allowed to circulate behind the entire picture." In order to accomplish this a light framework of wood is to be placed at its back. The action of the sun upon paintings is rapid and fatal. This may be guarded against "by affixing blinds to those windows which are exposed to the sun's influence, or by covering the glass with a dead whitish colour." As far as possible, the placing of candles near pictures should be avoided, "the greasy smoke of the candles mingling with the dust and damp on the picture forms a glutinous matter which mars the beauty of the colouring." Other evils and accidents, too, arise from the proximity of lighted candles. "Dust and traces of damp should frequently be removed, and with extreme delicacy of touch." For this purpose it is best to employ an old linen rag or silk handkerchief. "Above all the use of oil for giving a temporary brightness to the picture must be avoided." When this pernicious practice is followed, the oil is absorbed by the colouring and the canvas, or panel, and the picture will inevitably become blacker day by day. "In fact, nothing can be more disastrous in its effects than the use of oil in such cases."

The Warrior is lying at Devonport, sadly disabled by her experimental cruise, and undergoing considerable repairs and alterations. Her bowsprit, which was found to be too long and too heavy, has been removed, and a shorter and lighter one is being prepared to supplant it. Both her cylinder covers are split, and new ones are in the course of manufacture. The capstans are broken, and will require extensive repairs, if not renewal. The foremast is said to be too far forward and there are other defects of a minor character to be remedied—if possible. Sad accounts have reached us also as to the Warrior's behaviour at sea. Independantly of her obstinate refusal to obey her rudder, she experienced much difficulty in "righting" herself from the effects of one wave before being struck by another, and those on board sometimes expected nothing less than that she would "incontinently" go down. The Warrior is indeed "cranky," and that is a fault the disastrous consequences of which in a heavy gale it is painful to think of.

We are glad to learn that the trustees of the British Museum have resolved to make very liberal arrangements with regard to the opening of the British Museum during the period of the International Exhibition. We understand that the museum is to be kept open five days in the week, and until eight o'clock in the evening. Further, that the public are to have free access to the reading-room on each day betweem the hours of five and eight p.m. It is, we believe, not yet decided whether the museum shall be closed on Thursdays or on Saturdays; but we trust that the latter will be one of the open days. The trustees and directors of our other national institutions will, we hope, follow this good example.

Thomson Hankey, Esq., M.P., has sent a list of queries to the Lord Mayor, with the following note:—My dear Lord Mayor,—I enclose a list of queries which I should probably put to any witnesses who would kindly attend on our Fire Committee on behalf of the City of London, and should be quite ready to put any others which the witnesses might desire, in order to give us such information as might be in their power as to the existing state of the laws, the efficiency, sufficiency, defect, or otherwise, for the general protection of London against losses by fire. Our object is not to go into the question—as far, at least, as we can avoid it—as to the origin of fires, but, assuming that fires do occur, to inquire what is the best form of organization in any large town for the general protection of the inhabitants against such calamities, and by what means the expenses attendant thereon can most equably be defrayed. Before we go, however, into the question of future organization, it is necessary to obtain all the facts we can as to existing laws, and as to the existing rights, which have, to a certain extent, supplanted the existing laws. We have evidence laid before us from the Home Office that it is not the intention of the fire insurance companies to keep up the present Fire Brigade. It is for us to take the best evidence we can as to whether London can safely be left without such a fire brigade; if not, whereunder whom it ought to be placed, and by what means the expense should be defrayed.

The weekly meeting of the Society of Arts was held on Wednesday last, the Right Hon. C. B. Adderley, M.P., in the chair. The paper read was "On our Colonies; their Commerce and their cost," by Henry Ashworth. The author argued that the advantages which might reasonably be expected to result from our colonies to Great Britain were the extension of the manufactures and the trade of the mother country by the demand for home products in the colonies; the consequent impulse given to industry at home, and the opportunities to industrious labourers to emigrate to countries where land is cheap and wages higher, and that if a colony did not accomplish these objects, but became a source of expense to the mother country, or if the colonists should by regulations and restrictions choose to embarrass the trade between the mother country and them, then in such cases the parental design had been frustrated, and the relations on which the settlement had been based no longer existed in healthy action. He pointed out how by protection duties, injurious results were in his opinion brought about. He gave in great detail the statistics showing the cost of the colonies to this country, and his object was to prove that we did not receive an adequate return for the outlay. Some discussion followed, and the proceedings terminated in the ordinary way.

A new undertaking has been for some time in course of preparation, and is respectably constituted, namely, Stevens' Patent Bread Company. The value of this machinery for making bread is attested by a remarkable series of testimonials from numerous public establishments, including prisons, lunatic asylums, hospitals, &c. The machine is likewise used by numerous master bakers, who commend it highly, and has been otherwise satisfactorily tested. Amongst its chief advantages are, cleanliness, healthiness, and economy both of time and material. It is probably chiefly valaable in an economic sense. In addition to the large profit anticipated from the sale of the patented machines, it is intended to establish central bakeries for the supply of perfectly pure bread. The capital is £60,000 in shares of £2 each. The accounts are to be under the constant supervision of an accountant unconnected with the resident officers of the company.

Interesting Geological Discovery at Hastings.—The fall of the cliff near Hastings has brought to light an interesting slab of stone bearing on its surface the clear impression of the foot of a gigantic bird. It has three toes, each of which is about nine inches long in the tread, with a claw at the end, of perhaps two inches in length. The back of the foot, where the three toes meet as in a centre, does not appear; that part of the foot did not reach the ground. But still further back is the mark made by the point of the spur, or fourth toe. From the point of the middle claw to the mark of the spur it measures twenty-four inches, and in width twenty inches. The whole of the slab is covered with the lines of ripple made by the waves upon soft mud, and there are numerous other impressions more or less perfect of the same bird's claws on other slabs of stone. The bird which has left us this footprint may be supposed to have been at least twelve feet high, and perhaps much more. Mr. Jones, of the Geological Society, Somerset House, suggests that it may not be the footmark of a bird, but probably of the iguanodon. But he has not seen the original slab.—*West Sussex Gazette.*

MEETINGS FOR THE WEEK.

Mon.—*British Architects*, "On the Leonine City," by Rev. R. Burgess, B.D., at 8.30 p.m.
London Inst., "On the Instrumental Music of the Opera," by Josiah Pittman, Esq., at 7 p.m.
United Service Inst., "A short Cruise on the West Coast of Africa, in connection with the Slave Trade and Commerce," by Captain J. Craufurd' R.N., at 8.30 p.m.
Medical Soc., Clinical Discussion at 8.30 p.m.
Tues.—*Inst. Civil Engineers*, I. "Railway Accidents," by Captain Douglas Galton, R.E. II. "Railway Accidents," by Mr. Bramlees, M. Inst. C.E., at 8 p.m.
Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., at 3 p.m.
Wed.—*Geological Soc.*, I. "On some Remains of *Chiton* from the Mountain-limestone of Yorkshire," by J. W. Kirby, Esq. II. "On the Occurrence of Mesozoic and Permian Faunæ in Australia," by the Rev. W. B. Clarke, F.G.S. III. "On some Reptilian Remains from the Coal-measures of the South Joggins, Nova Scotia," by Prof. Owen, F.R.S. IV. "On some Fossil Foot-prints from Hastings," by A. Tylor, Esq., F.G.S., at 8 p.m.
Society of Arts, "On the Introduction and Use of Elastic Gums and Analogous Substances," by J. Walter, Esq., at 8 p.m.
Thur.—*Antiquaries*, Special Exhibition of English Autographs, at 8.30 p.m.
Royal Inst., "On Heat," by Professor Tyndall, at 3 p.m.
Linnean, at 8 p.m.
Soc. for the Encouragement of the Fine Arts, Conduit-street, "On Common Things in reference to Art," by Jas. Fahey, Esq., at 8 p.m.
Royal Soc., at 8.30 p.m.
Fri.—*United Service Inst.*, at 3 p.m.
Royal Inst., "On the Post Office," by Commissioner N. D. Hill, at 8 p.m.
Sat.—*Royal Inst.*, "On Spectrum Analyses," by Prof. H. E. Roscoe, at 3 p.m.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., *None.*
Boilers and their Furnaces, &c., 2171, 2188, 2207, 2222, 2255.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2199, 2209, 2212, 2236.
Ships and Boats, including their fittings, 2246.
Cultivation of the Soil, including agricultural and horticultural implements and machines, *None.*
Food and Beverages, including apparatus for preparing food for men and animals, 2186.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2170, 2182, 2189, 2190, 2192, 2193, 2204, 2210, 2223, 2225, 2231, 2232, 2237.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2211, 2235, 2213, 2250.
Lighting, Heating, and Ventilating, 2176, 2221.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2172, 2173, 2177, 2180, 2206, 2208, 2214, 2218, 2242.
Metals, including apparatus for their manufacture, 2178, 2197, 2239.
Chemistry and Photography, 2238.
Electrical Apparatus, 2181.
Warfare, 2216, 2218.
Letter-Press Printing, &c., *None.*
Miscellaneous, 2174, 2175, 2179, 2183, 2184, 2185, 2187, 2191, 2194, 2195, 2200, 2201, 2202, 2205, 2213, 2215, 2217, 2219, 2220, 2224, 2226, 2227, 2229, 2230, 2233, 2234, 2236, 2240, 2241, 2244, 2247, 2248, 2249, 2251.

2170. H. Reach. *An improvement in the ornamentation of woven and other fabrics for garments and parts of garments.* Dated August 31, 1861.

Here the inventor cuts with tools, or punches pieces of paper in various forms or figures, and which he afterwards embosses with dies; or he first embosses, and then perforates with dies, punches, or tools, pieces of paper representing ornamental forms and figures, which he attaches by an adhesive substance to various parts of the woven or other fabric, so as, when combined, to form a pattern. *Patent abandoned.*

2171. P. Taylor. *Improvements in apparatus for removing the sediment from, and preventing incrustation in, steam boilers.* Dated August 31, 1861.

This consists in applying a pipe to the interior of a steam boiler, which pipe is made with a longitudinal slot or slots extending the whole or the greater part of the length of the boiler, and communicating with an off pipe in which is a discharge valve, capable of being opened and closed rapidly. The valve is of the usual mushroom shape, and in the boss or on the spindle of the valve is a fixed stud; the groove is of such an inclination that, by turning the spindle about one-half round, the valve is opened sufficiently to discharge the sediment, which enters the pipe through the slot or slots above referred to. *Patent completed.*

2172. F. M. Jones. *Improvements in apparatus for suspending and turning meat, fowls, and such like articles for roasting.* Dated August 31, 1861.

Here the patentee has a spindle supported vertically in a suitable frame for the said apparatus, on which spindle is fixed a horizontal escape wheel gearing into the pallets or teeth at the centre of an oscillating bar, and on the ends of the said bar are adjustable weights, free to slide, for regulating the speed of the apparatus. To the lower end of the escape wheel spindle is connected the hook on which the article to be roasted is placed, and the spindle is, therefore, carried through the lower bearing resting therein on a shoulder on the said spindle, and projecting below the case in which the apparatus is enclosed. Motion is given to the escape wheel by a weight suspended by a line or chain, which passes round a pulley fixed on the spindle, and such motion continues until the weight has run down, when, as the escape wheel is free to turn in either direction, the apparatus may be again set in motion by removing the weight to the other end of the line or chain. *Patent completed.*

2173. W. Southwood. *An improved method of making boots and shoes, or of parts thereof.* Dated August 31, 1861.

This consists in riveting or leaving the inside points or ends of the nails, pegs, or screws when the boots and shoes are finished, between the leather or material of, or forming the inner soles of, boots and shoes, when an inner sole, and more than one, is used. But when one only is used, the inventor claims the riveting or leaving the inside points or ends of nails, pegs, or screws, when the boots or shoes are finished, between the leather or material substantially as desired. *Patent abandoned.*

2174. C. Pemberton. *Improvements in railway, ship, and other signals.* Dated August 31, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2175. J. Copple and E. Copple. *Improvements in apparatus to prevent overwinding at coal and other mines.* Dated August 31, 1861.

This relates to a self-acting disengaging apparatus, which, when used for lifting a cage, tub, or other weight from a pit or mine, serves as part of the winding rope or connection to the said cage or tub, but which, when disengaged by overwinding, consists of two pieces of mechanism, the one of which is attached to the rope, and has arms kept expanded by springs, the other is attached to the cage or tub, and has the necessary spaces and studs to receive and secure the arms just mentioned. The disengaging is secured by having placed in the framing at a sufficient height above the mouth of the pit or mine two horizontal bars or shafts, on which move friction rollers at a distance apart just sufficient to compress the disengaging apparatus, and allow that part to be drawn through whilst the other is retained. 2. To the catching apparatus, which consists of strong rods and bars suspended from or affixed to the framing, and kept at equal distances apart by springs, &c., the distance being less than the width of the lower part of the disengaging apparatus. As soon as the uncoupling takes place, the lower part of the apparatus rests on the carrying or supporting bars above referred to, and the cage, tub, or other weight is thus suspended and free from danger. 3. To a trap door, placed about half-way up the framing, and so arranged as to act as a further security against accident. *Patent abandoned.*

2176. E. J. Hughes. *An improved apparatus for collecting the gases which escape from furnaces.* (A communication.) Dated August 31, 1861.

This invention is carried out in the following manner:—Upon the plate of the furnace, and surrounding its opening, is a conical cast-iron ring, fitted round the chimney, and provided with a suitable number of openings to feed the furnace. At the upper part of the furnace is placed a helmet-shaped pipe for receiving and delivering the gases as collected. Around the bottom end of the said receiving pipe is riveted an angular iron hoop, which serves as a base for another conical ring which surrounds the gas pipe, which ring, by vertical bars and screws, can be brought into a horizontal position. The apparatus has a cover, which can be raised by balance-levers, to admit of the materials to be melted. A hemispherical valve is provided, which closes by its own weight, and opens if the gases freely flow, thus serving as a safety valve. To prevent the bursting of the cover and the conical rings, a narrow piece of sheet metal is riveted on them. *Patent abandoned.*

2177. J. Jones. *Improvements in clasps or fastenings for garments, belts, harness, and like articles.* Dated August 31, 1861.

This consists, principally, of two wedge-shaped parts, the one of which is smaller than, and is made of such a form as to be easily passed into the other, to fasten or join together two ends, edges, or sides of articles of wearing apparel, belts, harness, and other ends, edges, or sides of articles or apparatus of whatever nature, always provided that the said wedge-shaped parts or clasps are fastened by sewing, or otherwise, to the said ends, edges, or sides of the articles or materials to be joined together. *Patent completed.*

2178. W. A. Gilbee. *Improvements in the process and apparatus for the manufacture of steel.* (A communication.) Dated August 31, 1861.

This invention (the details of which we cannot give space to here) consists, mainly, when converting moulded cast-iron into steel, in causing a current of steam to pass over the iron to be decarbonised, during several hours, when it becomes converted into steel. In converting fluid cast-iron into steel, a specially-constructed apparatus is employed, in introducing the metal into which it is caused to form into thin sheets, and is treated with powdered lime. *Patent abandoned.*

2179. J. M. Dunlop. *Improvements in cleansing cotton seeds, and in machinery used for such process.* Dated August 31, 1861.

Here the cotton seeds are retained in the hopper, or case, in presence of the saw teeth of the gin, and are again and again acted on thereby, until they are well and sufficiently claimed or freed from the small quantities of cotton which constantly adheres to them when removing cotton from the seeds as now practised. *Patent completed.*

2180. W. Fox. *Improvements in parasols and umbrellas.* (A communication.) Dated August 30, 1861.

Here springs are applied to the runners in such positions that the stretchers, when a parasol or runner is closed, may each rest against a spring, having a tendency to force the end of the stretcher, near where it is attached to the runner, away from the stick of the parasol or umbrella, so that on opening a parasol or umbrella, the upper ends of the stretchers, when free, are caused to incline away from the stick by the springs before named. *Patent completed.*

2181. C. W. Siemens. *Improvements in apparatus employed in connection with electric telegraphs, part of which improvements are also applicable to ascertain the heat in accessible places.* (Partly a communication.) Dated August 31, 1861.

We cannot here devote space to the voluminous details of this invention. *Patent abandoned.*

2182. F. Curtis. *Forming or shaping woollen or mixed fabric boot tops or uppers from flat woven material.* Dated August 31, 1861.

These boot tops or uppers are formed into the required shape by damping the material employed, and suitably pressing the same with a hot iron. *Patent abandoned.*

2183. G. F. Goransson. *Improvements in the manufacture of tyres for railway wheels, part of the said improvements being applicable to the consolidating or rendering homogeneous iron and steel for other purposes.* Dated August 31, 1861.

This consists in casting the hoops of steel and malleable iron, somewhat broader than the wheels intended to be formed from them; these hoops are then placed in a bass made strong enough to retain the metal in shape under the next operation. Inside this bass, and also inside the hoops to be operated upon, is placed a punch or circular metal piece of the size of the inner diameter of the hoop; the hoop being placed between the bass and punch, it is then operated upon by a power hammer, the hammer piece of which may be round, so as to cover the whole circumference of the hoop at each stroke, or of the ordinary construction, this hammer being employed to consolidate or render homogeneous the metallic hoops; the hoops are afterwards rolled to the size required. *Patent abandoned.*

2184. T. S. Stock, J. S. Stock, and H. Taylor. *A new or improved tap or stop-cock.* (A communication.) Dated Sept. 2, 1861.

This consists in a tap or stop-cock in which the water way is opened and closed by a valve which is pressed upon and lifted from its seat by a rod, to which rod the handle of the tap gives motion by a crank or eccentric. This invention is not described apart from the drawings. *Patent completed.*

2185. W. Clark. *Improvements in signal apparatus applicable for the prevention of railway train collisions.* (A communication.) Dated Sept. 2, 1861.

This relates to a self-acting apparatus for indicating to the driver of a train whether the line is clear, and the preceding train at the proper distance ahead or not. The tender or other part of the train is furnished with an inclined bar of wood, which by acting on a roller forming part of the apparatus, will move a jointed bar of the said apparatus into position to signal a subsequent train that the line is blocked. This apparatus is not disengaged until the train passes beyond the corresponding apparatus placed at suitable distance ahead connected to the before named by wires. These apparatus, which are placed at suitable distances apart on the line, are connected alternately to each other by wires, that is to say, the first apparatus is connected to the third, and the second to the fourth, and so on. On the locomotive is placed an indicating disc and bell, which are put in action by a crank acted on by the pointed bar before-named, which causes the disc to turn a quarter of a circle, and at the same time the clapper on the stem of the disc strikes the signal-bell and warns the engine-driver that the preceding train has not passed the apparatus in connection with which the signal (of the line being blocked) is given. *Patent completed.*

2186. W. Mollea. *Improvements in apparatus for roasting coffee, which improvements are also applicable to the roasting of cocoa and other vegetable matter.* Dated Sept. 2, 1861.

This invention is carried out in the following manner. Within a circular vessel, adapted to be placed on an ordinary fire, the patentee applies a vertical axis with arms or vanes to keep the contents in motion whilst over the fire. To this vessel he applies a movable cover, and a movable handle to give motion to the axis and afford facility for the removal of the cover, besides a handle or handles by which to hold the vessel on the fire during the roasting. *Patent completed.*

2187. J. Hall. *Improvements in portable pumps or engines for extinguishing fires, and other purposes.* Dated September 2, 1861.

This consists in forming the bed and carriage (which is mounted on wheels) in one piece, in which are cast passages for water from the suction or inlet to the pumps, and from the pumps to the air vessel are secured to facings on the bed, and the inlet and outlet orifices are arranged above the level of the passages in the bed. The two pumps are actuated by a beam lever fixed on a shaft carried by two brackets or standards, one secured on each side of the bed, and this shaft is worked by a beam lever with folding handles. The lift of the pumps, or extent of the oscillation of the beam lever is determined by stops, formed by projections from the side brackets carrying the shaft. *Patent completed.*

2188. J. Watson. *Improvements in furnaces.* Dated September 2, 1861.

This consists in a peculiar arrangement of the air passages and fire bridges, whereby the fuel is more effectually and economically consumed, the stoppage of the draft from the accumulation of clinker is entirely prevented, and, at the same time, the visible smoke is consumed. *Patent completed.*

2189. E. Alcan. *Improvements in machinery for carding and combing wool and other filamentous substances.* (A communication.) Dated Sept. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2190. A. N. Salkers. *Improvements in printing and colouring paper, chintz, and other fabrics, and in machinery or apparatus for the purpose.* Dated Sept. 2, 1861.

This invention is carried into effect by means of a series of cylinders, and a colouring trough, whereby one colour or any number of different colours may be printed on paper, chintz, and other fabrics. *Patent completed.*

2191. G. Knight. *Improvements in giving lustre to written and printed letters, figures, and devices.* Dated Sept. 2, 1861.

Here the letters, figures, and devices are to be written or printed with adhesive compounds, paints, or inks, or have such substances applied to them after being printed, in order that pulverized lead ore (native sulphuret of lead or galena) may be dusted thereon, or be otherwise applied thereto, so that, when dry, the compounds, paints, or inks used may securely hold the pulverized lead ore. *Patent abandoned.*

2192. W. Campion and H. Johnson. *Improvements in machinery and apparatus for cutting the selvages or edges of knitted or other fabrics while being stitched.* Dated Sept. 2, 1861.

This consists in machinery or apparatus in which is a pair of cutters of suitable construction applied to, or combined with, an ordinary sewing or stitching machine, by means of which the patentees cut the selvages or edges of knitted or other fabrics while they are being stitched, and at the same time lay down the selvage smoothly. *Patent completed.*

2193. D. Warr. *Improved machinery for twisting and laying flax, hemp, and other fibrous materials.* Dated Sept. 3, 1861.

This consists in the manufacture by machinery of "laid cord," or "laid twine," which has usually been manufactured in long rope walks, principally by hand labour. The threads or yarns or bobbins, which are placed in the machine on spindles, provided with loose flyers, to which are applied adjustable tension weight and springs adapted to each other, so as to allow the yarn to come evenly off the bobbin, a twist is given to the thread, by driving the spindles and flyers at a suitable speed in the required direction by means of suitable gearing. The threads are next conducted over a breast roller to another spindle and flyer, revolving in a direction opposite to that of the spindles and flyers from which they first received their twist. By these means the previously twisted threads or yarns are laid and twisted together into a hard twine or cord, which is drawn on to the bobbin on the spindle by means of a roller or pulley, driven by independent gearing at a speed proportioned to that of the flyer, according to the twist required to be put into the finished cord or twine. *Patent completed.*

2194. J. Gresham. *Improvements in mechanism or apparatus for facilitating the stopping and starting of omnibuses and other vehicles.* Dated Sept. 3, 1861.

This consists in the use of springs, air, or other elastic medium, weights, or the pressure of the atmosphere. The springs are charged, the air or other elastic medium is compressed, the weights are lifted, or the atmosphere is withdrawn from a cylinder by mechanism brought into gear with the wheels of the vehicle by a suitable lever handle, and connecting and transmitting mechanism, when the vehicle is to be stopped; then when the vehicle is to be set in motion again, the force thus reserved and accumulated will be made, by reversing gear, to react upon the wheels of the vehicle, and start or assist the starting of the vehicle into motion. *Patent abandoned.*

2195. E. Suckow and E. Habel. *Improvements in machinery or apparatus for producing a strong blast or current of air.* Dated Sept. 3, 1861.

Here the patentees enclose an Archimedean screw in a cylinder, and give it a rapid rotatory motion. The screw is composed of any number of blades which are fixed to a conical disc, and have their outer edges revolving nearly at a right angle to projections or catch-rings, fixed to, or forming part of the cylinder. When motion is given to the screw, a strong blast or current of air is produced, similar to that of an ordinary fan, but with a much more powerful effect. They also apply antifriction rollers, when desired, to work against the prepared surface or collar of the shafts in order to lessen the friction. *Patent completed.*

2196. P. Robertson. *Improvements in treating yeast, and in the manufacture of ammonical salts, and a substitute for animal charcoal.* Dated Sept. 3, 1861.

Here, in treating yeast, the inventor separates moisture from the yeast by means of a centrifugal machine, pressure, or otherwise, and dries it in a chamber having shelves on which are placed trays containing sulphuric acid, chloride of calcium, carbonate of potash, or lime. A vacuum is obtained in the chamber by exhausting pumps or otherwise; the yeast is then reduced to powder and it is fit for use. The powder may be stored in bottles or other closed vessels. *Patent abandoned.*

2197. G. Bischof, Jun. *Improvements in extracting copper and silver from ores containing these metals.* (Partly a communication.) Dated Sept. 3, 1861.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

2199. T. Scott. *Improvements in the construction of roadways.* Dated Sept. 4, 1861.

This consists in the use of trays or open boxes or frames of cast or wrought iron and wood, or other materials, with a flat arched bottom and vertical sides; which trays or boxes are packed full of rough or dressed flat pieces of stone, or other material placed on edge. These trays may be set in sand, gravel, or otherwise, to form one solid block; these trays or boxes so filled are placed on the prepared foundation of the roadway with the stone surface uppermost. *Patent abandoned.*

2200. R. A. Brooman. *A new or improved parachute toy.* (A communication.) Dated Sept. 4, 1861.

This invention consists in constructing a parachute toy, by combining with a parachute a box, which is used for throwing the toy in the air as hereafter explained, and which is fixed to the parachute by threads. The box folds or doubles up at the centre, and forms a case in which the parachute and connecting threads are enclosed. Doubled up, and with a string with a weight at the end wound two or three times round two points in which the ends of the case terminate, the toy is thrown into the air, the string unwinds from the points, when a spring causes the case to open and assume somewhat the shape of a boat. The parachute expands, maintains its position over the boat-like case, and after the manner of a parachute of an aerostat, the toy descends slowly. *Patent abandoned.*

2201. W. E. Newton. *Improvements in self-acting brakes, applicable to railway or locomotive engines and carriages.* (A communication.) Dated Sept. 4, 1861.

This consists of mechanism, whereby the progress of the engine or carriage to which it may be applied may be arrested on inclined planes, by means of a nipping apparatus or pincers, made to seize and embrace the rails. The nipping apparatus comes into action on the breaking of the traction rod or chains. *Patent completed.*

2202. L. R. Bodmer. *Improvements in distilling apparatus.* (A communication.) Dated Sept. 4, 1861.

This consists, 1, in the peculiar construction of the distilling column, differing essentially from the system of construction hitherto known, by the small number of platforms required, by the greatly reduced height, by exposing but a small surface to the external air as compared with the columns at present in use in which the surrounding air is heated at the expense of the fuel employed, and, finally, by the rapidity of its operation and the saving of fuel resulting therefrom. The invention is not described apart from the drawings. *Patent completed.*

2204. J. K. Bayley, T. Harrison, W. Briggs, and R. Parker. *Improvements in machinery for preparing and spinning cotton and other fibrous materials.* Dated Sept. 5, 1861.

This consists in giving about twice the usual amount of twist to the roving that is formed on the slubbing frame, and in driving the spindles by the usual gearing, but the inventors dispense entirely with the gearing now used for driving the bobbins, which are taken round by the drags of the roving, the bobbins formed on the slubbing frame are taken to the roving jack frame, and there made to revolve in order to unwind the whole or greater part of the twist that had been given in the previous machines, by this means the roving entering the drawing rollers is almost or entirely free from twist and therefore in the best condition for being drawn; in these frames also the spindles are or may be driven as usual and the gearing for driving the bobbins dispensed with, the bobbins or spools from the roving or jack frames are taken to the spinning machine, and there unwound to remove the twist as before described. *Patent abandoned.*

2205. H. Young. *Improvements in counter or pillar beer engines.* Dated Sept. 5, 1861.

Here the inventor fixes the engine or pump below the plate which is fixed to the counter, and above the said plate is a cylinder or column in which the parallel motion of the piston rod works. Near the top of the column, and on one side thereof, the lever is situated by which the engine is worked, and the pipe which delivers the liquid passes up the said column. Or the parallel motion as well as the engine or pump may be placed beneath the counter plate. In this case the lever is jointed to one side of a dome on the said plate, in which dome the short arm of the lever works. *Patent abandoned.*

2206. R. McConnel. *Improvements in locks.* Dated Sept. 5, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2207. J. M. Rowan and T. R. Horton. *Improvements in steam boilers and surface condensers.* Dated Sept. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2208. C. Enkins. *Certain improvements in ladies' dress suspenders.* Dated Sept. 5, 1861.

Here, if the suspender be made of wire, and the parts for holding the dress are secured in position by a link in the form of a figure eight, the patentee forms the top or spring end so as to prevent the said loop or link from readily getting out of position, the parts for gripping or holding the dress being formed of a centre bar terminating with a broad flat eye, the bar pressing between a fork formed at the other corresponding part of the suspender. This arrangement may be modified by forming the spring of an additional twist or turn of the wire at the spring end. *Patent completed.*

2209. J. E. Ridges, and J. Backes. *Certain improvements in composite carriages for funeral and other purposes.* Dated Sept. 5, 1861.

This consists in a method of constructing hearses whereby a compartment is formed in front for receiving the coffin. At or near the centre of this compartment a strong vertical axis projecting upward from the top, and also if required downward from the bottom, is placed, the same being secured firmly to the material forming this compartment, over which strong straps or arms of wood or iron are placed at top and bottom, also when a lower centre is applied, connected with the body of a carriage for receiving the mourners usually attending funerals. This body is mounted on a pair of wheels with springs in the ordinary way, and fitted with a door at the back or side; and the horizontal axis of the front wheels is attached to the coffin compartment, to which also is attached the driving box and pole or shafts, the whole working on the axis projecting upward and downward as described. *Patent completed.*

2210. D. and J. Heyworth. *Certain improvements in looms for weaving.* Dated Sept. 5, 1861.

This invention comprises much detail which we cannot produce here. *Patent abandoned.*

2211. P. Effertz. *Improvements in machinery or apparatus for making bricks, tiles, drain-pipes, and other similar articles.* Dated Sept. 5, 1861.

Here the clay is fed into the machine through a hopper, mixed by a combination of screws through a grate, to be cleansed from stones, &c., modelled or moulded by pressure to the desired shape, and received as an endless band by a rolling table in front of the machine. This rolling table has a self-acting cutter put in motion by the band of clay emerging from the machine, and cutting the said band into any length desired at right angles to the surface, or at an angle proportionate to the velocity. The necessary pressure is exerted through a combination of screws requiring less power than any other now in use. The invention is not described in detail apart from the drawings. *Patent completed.*

2212. J. T. Pensam. *Improvements in wheels for facilitating the progress of carriages on common roads and in the means of propelling the same.* Dated Sept. 5, 1861.

This consists in providing wheels with legs or levers capable of sliding beyond the peripheries of the said wheels, for the purpose of enabling the same to obtain a firmer hold upon the ground, and thus, actuated by any motive power, facilitating the progress of the carriages. *Patent abandoned.*

2213. F. Bennett. *An improved method of coating the interior surface of lead and lead composition pipes with tin or its alloys.* Dated Sept. 5, 1861.

This invention relates to those lead or lead composition pipes which are manufactured by hydraulic pressure, and consists in forming the core or mandril, over or round which the pipes are formed, hollow or tubular, and in causing the tube or hollow in the mandril to communicate with a reservoir or supply of tin or alloy of tin, the level of which is maintained at such a point that the tin will just overflow the lip or upper end of the tubular mandril. As the leaden tube is formed over the hollow core or mandril, so it receives a uniform coating on the interior of the tin or tin alloy, which is kept flowing over the lip of the mandril. *Patent completed.*

2214. W. Patey Jun., and J. Richardson. *Improvements in the manufacture of brushes.* Dated Sept. 5, 1861.

The inventors form different classes of shaving brushes, having the handles or rigid parts of glass, either blown, moulded, or otherwise fashioned by ordinary or suitable methods of working that material. *Patent abandoned.*

2215. T. Scott. *Improvements in utilizing the surplus momentum of railway trains and other moving bodies, and the waste and surplus power of locomotive and other engines.* Dated Sept. 5, 1861.

The inventor utilizes such surplus momentum by causing it to actuate condensing pumps, or other apparatus for forcing air into a tank or reservoir capable of sustaining a high pressure, by which means he obtains, in the case of railway trains or other moving bodies, a resisting force capable of retarding motion, and acting in a brake. *Patent abandoned.*

2216. I. Napier. *Improvements in the manufacture of armour plates for the protection of vessels of war, floating and other batteries.* Dated Sept. 5, 1861.

Here the inventor takes a large slab or bloom, or a number of such, or a number of rolled or otherwise made plates, and heats them, and then by means either of hydraulic pressure, or pressure produced by screw or lever, or by a combination of mechanism, he squeezes them down to the required size. By making these hydraulic screw or lever presses, or a combination thereof, with the top or bottom or both of the plates between which the metal operated upon is to be squeezed either flat or with projections or recesses thereon, he is able to produce either plain armour plates as at present in use, or plates with flanges or projections, or thickened up pieces on either side, and on any part of their surface. Armour plates so made may be bolted together round their edges in the same manner as a cast iron tank is generally made. *Patent abandoned.*

2217. I. Napier. *Improvements in apparatus for cooling the water employed for condensing steam or other purposes.* Dated Sept. 5, 1861.

Here the inventor takes the water, after it has been discharged from the condenser, and lets it flow into a trough placed on the top, or forming part of a box or chest; in the bottom of this trough or shallow box, a number of tubes are placed, passing perpendicularly or otherwise through holes made in the bottom of the trough, and descending to some distance towards the bottom of the chest or box. These tubes, which are open at the top, where they fit into the tube plate or bottom of the trough, may be made of any porous material, or they may be made of any non-porous material, having small perforations all over them, through which the water can ooze or percolate. Through the box or chest in which these tubes are suspended so as to reach some distance towards the bottom, a current of cold air is forced or drawn, by fanners or other means, which current of cold air, coming in contact with the water as it drips or percolates through the suspended

Digitized by Google

tubes, cools it, so that it can be forthwith used again for the purpose of condensation. *Patent abandoned.*

2218. I. Napier. *Improvements in machinery for rolling iron or other metals.* Dated Sept. 5, 1861.

This consists in arrangements of machinery for rolling plates, bars, or other forms of iron or other metal, so as to produce a plate, bar, or other form, in a finished state from the slab, bloom, or pill, in less time, and whilst the metal is nearer a welding heat, than by the means at present employed for this purpose, by which arrangement, plates, bars, angle and other forms of iron and other metal can be made in longer lengths with greater facility than heretofore. *Patent abandoned.*

2219. C. W. Harrison. *Improvements in the construction of castors.* Dated Sept. 5, 1861.

This consists first in making the bowls, rollers, or wheels of vulcanized india rubber, or "vulcanite." *Patent abandoned.*

2220. T. Greenwood. *Improvements in machinery for sawing wood.* Dated Sept. 5, 1861.

This invention is not described apart from the drawings. The patentee claims inventing the tension pulleys of band saws on an adjustable rocking frame, whereby the angle of the saw blade to its work may be varied as described. *Patent completed.*

2221. J. Ried. *Improvements in the treatment of gas and the apparatus employed therein, with a view to its more accurate measurement in wet gas meters.* Dated Sept. 5, 1861.

Here the gas is caused to pass through a vessel which is divided by partitions, so as to cause the gas to take a circuitous route in its passage to the meter. And by this invention the gas is saturated with moisture before it enters the meter, and is thereby prevented from affecting the water line level. *Patent abandoned.*

2222. M. A. F. Mennons. *Improvements in smoke-consuming furnaces.* (A communication.) Dated Sept. 6, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2223. M. A. F. Mennons. *Improvements in ribbon looms.* (A communication.) Dated Sept. 6, 1861.

This invention is not described apart from the drawings. The patentee claims the application to jacquard, bar, and other ribbon looms of double sets of reeds, healds, and rollers, so constructed and arranged as to permit the simultaneous manufacture under the eye of the weaver of double superposed pieces of the tissue. *Patent completed.*

2224. M. A. F. Mennons. *Improvements in obtaining and applying motive power.* (A communication.) Dated Sept. 6, 1861.

This consists in the substitution of the Archimedian screw to hydraulic wheels and similar motors, by means of which water power is commonly applied to the production of mechanical action. *Patent completed.*

2225. W. Spence. *Improvements in apparatus for dividing and softening vegetable fibres.* (A communication.) Dated Sept. 6, 1861.

Here there is used a machine consisting of a revolving cylinder with longitudinal grooves on its circumference, surrounded by a stationary circular case having longitudinal grooves on its internal surface, the material to be operated upon being introduced into the space between the said cylinder and its surrounding case. There is an opening at one side of the case, through which the material is introduced into the machine over an endless feeding cloth or apron, so as by the revolution of the cylinder to draw in the material to be operated upon at one side of the case, and throw it out thereof after being operated upon at the upper part of the same on to an inclined plane. The case is kept in position by springs or weight. *Patent completed.*

2226. W. Allott and J. Thelwall. *Improvements in the manufacture of wheel tyres, hoops, and other similar articles.* Dated Sept. 6, 1861.

Here the inventors produce two rings, composed each of a bar coiled in a helical form, the coil of one ring being in the opposite direction to that of the other, and the ends of the bar being tapered off so as to leave an even fall on the ends of the helix or side of the ring. One of these rings is made of smaller diameter than the other, and is fitted inside the larger one, and as they are coiled in opposite directions the joints or seams will cross each other, thereby considerably increasing the strength of the tyre or hoop, which is free from the usual weld, and is not liable to split as ordinary tyres are. Any desired number of such rings or coils may be insulated one inside the other, according to the strength and dimensions of the tyre to be produced, care being taken that no two adjoining coils are in the same direction, in order that the crossing of the seams or joints may be insured. The blank tyre or hoop thus formed is now welded under the steam hammer, and then finished by rolling. *Patent abandoned.*

2227. W. Allott and J. Thelwall. *Improvements in the manufacture of crank shafts and crank axles and other similar articles.* Dated Sept. 6, 1861.

Here the inventors first take a straight or nearly straight shaft, which may be made of faggots either of a square or other section, and after heating it to a welding heat, they place it under a steam-hammer, and forge by the aid of blows a slight bend or indendation in it where the crank is to be produced, such bend or indentation being gradually increased by successive heatings and blows from the hammer until the desired length of crank has been forged, the use of pressure and bending dies, and the application of end pressure on the shaft, being dispensed with. The shaft to be operated upon is placed over a suitable hollow matrix or aperture when under the hammer, so as to allow of the formation of the crank and its gradual elongation, a suitable hammer-face or striking tool being fitted to the hammer block to produce the proper width of crank. *Patent abandoned.*

2228. E. J. Hughes. *Improvements in watches.* (A communication.) Dated Sept. 6, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2229. C. F. Kirkman. *Improvements in obtaining manure from sewerage, and in apparatus employed therein.* Dated Sept. 6, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2230. J. J. Russell. *Preparing the ends of welded tubes previous to their being fixed in plates.* Dated Sept. 6, 1861.

Here the patentee employs a bath of fluid lead, or other metal or alloy, into which the ends of the welded tubes are immersed, and by this means they are readily and very uniformly heated to the extent desired. The ends of the tubes are next forced into powdered coke or charcoal, or sand, to exclude the atmosphere whilst the ends are becoming cooled. *Patent completed.*

2231. J. Brown. *Certain improvements in power looms for weaving.* Dated Sept. 6, 1861.

This relates, 1, to the "check strap" of that portion of the loom known as the "picking motion," and employed in looms to limit the movement of the picker, and is designed to diminish the wear of the "pickers" consequent upon their sudden stoppage and concussion upon such strap. The invention consists in the use of a strip of india-rubber, &c., at one end of the check strap, and so arranged that when the picker comes into sudden contact with the strap the elasticity of the india-rubber diminishes the force of the picker upon the strap, and prevents injury to the picker. The invention also relates to the heddles or harness of looms, and consists in furnishing or covering the surface of the rods between which the healds are distended with india-rubber, so that as the healds rise and fall during weaving the strain thereof may be diminished or equalized by the elastic substance. *Patent completed.*

2232. W. Wild. *Certain improvements in machinery or apparatus to be employed in the preparation of cotton and other fibrous materials for spinning, called "slubbing frames and roving frames."* Dated Sept. 6, 1861.

This consists in the use of a long tube or collar extending upwards from a rail beneath the "chopping rail" to that part of the spindle close beneath the "flyer," the spindle passing through the tube is thereby steadied. The improvement consists in the use of this peculiar elongated form of "collar" in contradistinction to any of shorter description, which do not afford support to the spindle closely beneath the flyer. *Patent completed.*

2233. E. Harrison and T. S. Yates. *A certain compound of certain compounds to be used as a substitute for gunpowder.* Dated Sept. 6, 1861.

This consists of an admixture of chlorate of potash' prussiate or per-prussiate of potash, sulphur, charcoal, anthracite, phosphorus, and potato, or an extract therefrom, in certain proportions. *Patent abandoned.*

2234. M. Henry. *Improvements in the means of signalling on railways.* (A communication.) Dated Sept 6, 1861.

This relates to signalling on railways by means of electricity, and consists in arranging and combining apparatus in which a conducting wire is used to bring together, or effect a meeting between the currents of the positive poles of two batteries (the "local" battery and the "travelling" battery), the respective negative poles of which batteries communicate with earth, by which means an alarm, furnished with electrical detent and situated in the circuit of the negative pole of the travelling battery, is caused to remain silent, but the apparatus is so arranged that the action of the local battery may be instantaneously interrupted, when required, and the aforesaid conducting wire, which had hitherto opposed the current from the local battery to that from the travelling battery, becomes a conductor to earth from the positive pole of the travelling battery, and the circuit being closed, the alarm included therein is caused to sound, and this alarm being placed in a locomotive, or other part of a train, will call the engine-driver's attention in case of danger. *Patent completed.*

2235. T. G. Messenger. *Improvements in glazing horticultural buildings, the roofs of railway stations, and other erections.* Dated Sept. 6, 1861.

This consists in laying glass in such wise that each edge of the glass (which glass may be of any required shape or size) shall be on one side of an open gutter, which said gutter may form a gutter only, or it may form a gutter and rafter, either cast or rolled in one or two parts; the said gutter is made to carry off all the condensed vapours from the interior, as well as the rain. *Patent completed.*

2236. E. Taylor. *Improvements in obtaining motive power.* Dated Sept. 7, 1861.

Here the inventor uses a number of weights placed upon a shaft or eccentric, and also a wheel, which revolves and changes the positions of the weights, the wheel having bowls on which the weights slide, so that, as the positions of the weights are changed, they gain their leverage, and give effect to the wheel, and thus obtain the motive power, which can be started and stopped, and also governed by altering the position of the shaft or eccentric. *Patent abandoned.*

2237. W. Ainsworth, E. Heap, W. Fielding, and E. Openshaw. *Certain improvements in power looms for weaving.* Dated Sept. 7, 1861.

This relates, principally, to that description of power looms wherein the shuttle-boxes rise and fall, and consists, 1, in a novel method of governing the rise and fall of such shuttle-boxes. 2. To a method of reversing the action of the pattern chain and its drum, by which the shuttle-boxes are actuated. 3. To a method of varying the number of "picks" of the shuttle. *Patent completed.*

2238. N. D. P. Maillard. *Improvements in the material and preparation of the material, and apparatus for making potash, pearlash, and caustic potash of commerce.* Dated Sept. 7, 1861.

This consists in a mode of producing potash, pearlash, and caustic potash from peat, or bog, or earth. *Patent completed.*

2239. J. Carpendale and T. Middleton. *A machine to produce raising, chasing on copper, silver, and Britannia metal by the application of pressure.* Dated Sept. 7, 1861.

This invention admits of the pressure required in producing raised chasing being obtained by the adjustment of the machine, instead of by manual pressure. *Patent completed.*

2240. G. Norris. *Improvements in the manufacture of soap.* Dated Sept. 7, 1861.

This consists in combining with the component parts of soap, during or before its manufacture, mucilage resulting from the pipes or seeds of the quince. *Patent completed.*

2241. J. Holland and G. Oxall. *Improvements in apparatus by which an engine or train is made to give an alarm or signal at any required place on arriving at or passing any given point on the railway.* Dated Sept. 7, 1861.

Here a treadle or treadles is or are arranged on a railway, so that the wheels of an engine or train, or some suitable projection or projections from the engine or train, will, in passing, act upon this treadle or treadles (the re-action being produced by springs), and give a motion to a pair of bellows, pump, or other apparatus, by which air can be forced past a valve, or valves, (by which it is prevented from returning) into a pipe which extends from this apparatus to the place where the alarm or signal is required to be heard, the air forced into the pipe sounding one or more whistles placed at the end of the pipe, as it branches from it, thus giving notice that an engine or train has passed the point where the treadle or treadles are fixed. *Patent completed.*

2242. H. Redgate. *Improvements in machinery for the manufacture of skirts usually called crinoline skirts.* Dated Sept. 7, 1861.

We cannot here, with advantage, give space to the voluminous details of this invention. *Patent abandoned.*

2243. R. O. White. *Improvements in the manufacture of bricks* Dated Sept. 7, 1861.

This applies when burning bricks in open clamps or kilns, where fire is mixed with the brick earth, and is also interposed between some of the courses. The bricks are set in one direction, and so that each course of bricks breaks course with the course above and below. *Patent completed.*

2244. G. H. Birkbeck. *Improvements in the construction of saddles.* (A communication.) Dated Sept. 7, 1861.

Here the frame or body of the saddle is formed of a number of plates and other forms of iron, steel, or other metal, jointed or connected together to give strength and solidity to the saddle, the articulations of the several divisions of the frame so joined together giving freedom of action to all parts of the saddle when in use, thus causing a uniform distribution of the load at each movement or change in the position of the rider. *Patent completed.*

2245. G. Malcolm. *Improvements in machinery or apparatus for softening or treating jute, hemp, flax, or other similar fibrous substances.* Dated Sept. 9, 1861.

Here a pinion on the driving shaft gives motion to a train of gearing, one part of which drives the rollers of an endless apron in which the material to be softened is placed. From the endless apron the jute, &c., passes between a pair of rollers, which rollers are arranged one above another, and carry the jute, &c. through a horizontal slot formed in each of a series of vertical rubbers. The jute, &c. passes out thorough a second series of stationary rubbers, and is carried forward by a pair of fluted rollers on to an endless delivery apron. The oiling of the jute, &c., is effected during its passage through the machine by suitable arrangements. *Patent completed.*

2246. W. Simons. *Improvements in, or connected with, ships or vessels.* Dated Sept. 9th. 1861.

This invention is not fully described apart from the drawings. *Patent completed.*

2247. W. Dowall and J. Dowall. *A new or improved motive-power engine.* Dated Sept. 9, 1861.

This consists essentially, of a wheel having an equal number of spokes or radii, being dimetrically opposite to another. Weights carried by the spokes or radii are worked so that those on one side of the wheel are always at a greater distance from the centre of the said wheel than the weights on the other side, and the wheel is not in equilibrium. The preponderating side of the wheel, consequently, descends, and each weight, after it has passed from the highest point through a semi-circle to the lowest point, is drawn in towards the centre while it rises, and is forced out again at its highest point. One half of the wheel is thus kept in a constant state of preponderance. *Patent abandoned.*

2248. P. H. O'Neill. *Improvements in screw wrenches or spanners.* Dated Sept. 9, 1861.

In constructing screw wrenches or spanners according to one part of this invention, the patentee attaches to the fixed jaw parallel bars; the movable jaw is made to slide along these bars, it being formed with two holes through it, through which the bars pass; the parallel bars have screw threads cut on them, on which nuts work, and by these nuts the moveable jaw may be set in any required position. The opposite ends of the parallel bars to those which are connected to the fixed jaw are united together; and at the point where they are joined together they have a point or projection formed on them, by which they can be connected to a handle. *Patent completed.*

2249. A. Favre. *Improvements in propellers and in propelling vessels through water.* Dated Sept. 9, 1861.

This consists in constructing and applying propellers by having a piston rod, or piston rods, or pairs of piston rods, made to work at the stern or at the sides, or other parts of the vessel as may be practically convenient, so that a prolonged part of each piston rod, or suitable additional rod or tube attached thereto, projects into the water. To the end of the part so projecting is attached the apparatus, and so constructed that an effective surface of sufficiently large extent is presented to the action of the water when the piston or pistons is or are making their outward thrust, and the vessel is thereby pushed or propelled forwards, and when the piston or pistons is or are drawn back, a small extent of surface is presented to the action of the water, so that a small resistance is offered by it to the outward motion of the piston or pistons. *Patent completed.*

2250. J. H. Johnson. *Improvements in fire grates and furnaces for domestic and other purposes.* (A communication.) Dated Sept. 9, 1861.

According to one arrangement of this invention, applicable to domestic fire grates, the grate itself is pivotted or made to rock upon centres, the centres being rather to the front than back of the grate, which will incline downwards towards the back. When the fuel requires stirring it is only requisite to depress two or three times the front of the grate, and allow it to fall back again. *Patent abandoned.*

2251. J. N. JOHNSON. *Improvements in machinery or apparatus for making cigars.* (A communication.) Dated Sept. 9, 1861.

This consists of certain mechanical arrangements (which we cannot here quote in detail), for cutting and delivering the proper charges of tobacco to be subsequently made up into cigars, and for rolling such charges inside the outer leaf. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Nov. 16, 1861.

2881. J. Grint, 45 Harrison-street, Gray's-inn-road, engineer and draughtsman. Improvements in pegs, nails, or like fastenings, for uniting the soles of boots and shoes, and other substances.

Dated Nov. 18, 1861.

2890. J. M. Clements, Birmingham, tailor and draper. Improvements in the making or manufacturing of certain parts of garments for either sex, likewise in the manner of preparing the same for sale, as also an improved button to be attached to garments without sewing.

Dated Jan. 25, 1862.

202. J. Brown, manager, and J. Davenport, pattern maker, Bolton. An improved lubricating apparatus, applicable to pistons.

Dated Jan. 31, 1862.

261. E. H. C. Monckton, Fineshade, Northampton, esquire. Improvements in the application of electricity for obtaining ammonia and other useful products during the combustion of coal and fuel, and in the apparatus employed therein.

Dated Feb. 12, 1862.

364. G. J. Aman, Liverpool, merchant. Improvements in envelopes or bags to hold grain or similar substances, for transmission by post or as parcels.

Dated Feb. 21, 1862.

468. S. Smith, 204 High Holborn, engineer. Improvements in electro-magnetic engines for obtaining and applying motive power.

Dated Feb. 22, 1862.

482. R. Foster, jun., Beeston, Nottingham, horticultural builder. Improvements in the construction of horticultural and other similar buildings or erections.

Dated March 3, 1862.

572. R. Shaw, jun., Portlaw, Waterford, cotton spinner. An improvement in fire-arms, by a more convenient method of placing the ramrod in position.

Dated March 5, 1862.

596. W. Hensman, Woburn, Buckinghamshire, and W. Hensman, Jun., Linslade, Buckinghamshire, agricultural engineers. Improvements in steam ploughs, and in apparatus connected therewith.

Dated March 7, 1862.

608. M. B. Newton, Wharf No. 4, Great Northern Goods Station, King's-cross. Improvements in the manufacture and construction of junction and other drain pipes in clay or other plastic materials.

610. J. Revell, Dukinfield, Chester, master plasterer and decorator. Improvements in securing the rails of railways and tramways to the chairs.

612. J. Fowler, Jun., D. Greig, and R. Noddings, Leeds. Improvements in apparatus for cultivating or tilling land.

614. R. Wright, 18 Albany-road, Camberwell. Improvements in heating and clarifying saccharine fluids.

618. H. B. Coathupe, Junior United Service Club, Saint James's, esquire. Improvements in the manufacture of clips, hooks, and other such like fastenings.

Dated March 8, 1862.

620. H. Fletcher, 82 Wood-street, Cheapside, warehouseman. An improved clip for securing the steel or other expanders of crinolines to the suspenders thereof.

622. A. Blair, Dawsholm Print Works, Dumbarton, calico printer. Improvements in rotatory engines.

624. S. S. Bromhead, Bristol, ironmonger. Improvements in the construction of boxes or receptacles for coals.

626. J. Deane, jun., King William-street, City, gun manufacturer. Improvements in revolving fire-arms.

628. J. Guyet, Paris, C.E. Improvements in water meters.

630. W. Clark, 53 Chancery-lane, engineer. Improvements in brims and peaks of hats, caps, and other coverings for the head. (A communication.)

632. J. Fleming, Mincing-lane. Improvements in machinery for pressing cotton. (A communication.)

634. L. R. Sykes, New Coventry-street. Improvements in gloves.

636. J. J. H. Gebhardt, Lawrence-lane, merchant. An improved fastening for albums and other books, bags, reticules, and other articles. (A communication.)

Dated March 10, 1862.

638. J. Duncan, Greenock, sugar refiner. Improvements in the manufacture of vinegar.

640. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in producing by the aid of photography copies of maps, charts, plans, and drawings. (A communication.)

642. W. Spence, 50 Chancery-lane. Improvements in projectiles. (A communication.)

644. A. C. MacLeod, Hanover-square, doctor of medicine. Improvements in ventilating hats and coverings for the head.

646. A. Barclay, Kilmarnock, engineer. Improvements in traction engines and in apparatus for indicating the pressure of steam.

650. H. H. Kromschroeder, 32 Princess-terrace, Regent's-park. Improvements in gas meters.

Dated March 11, 1862.

654. W. Barter, Brixham, Devon, master mariner. Improvements in apparatus for propelling vessels, and for enabling them to work off lee shores during storms.

658. C. Hall, Navestock, Essex, agriculturist. Improvements in implements for breaking up the soil, and in ropes and drums to be employed in the cultivation of the soil by steam.

662. G. Davies, 1 Serle-street, Lincoln's-inn, C.E. Improvements in attaching artificial teeth to plates and to each other, and in moulds for forming artificial teeth. (A communication.)

Dated March 12, 1862.

668. W. H. Latham, Bolton, foreman, and F. C. W. Latham, printer. Certain improvements in machinery or apparatus for cutting paper, pasteboard, and other similar substances.

670. J. Johnson, Heaton Norris, Lancaster, and S. Morris, Stockport, Chester. Improvements in steam boilers.

672. E. Molyneux, Jun., Seaview, Enniskerry, Ireland. An improved method of utilizing the waste heat of the products of combustion as they escape from a furnace, and securing a more complete combustion of the fuel.

674. A. M. A'Beckett, Surbiton, Surrey. Improvements in railway signal apparatus.

Dated March 13, 1862.

680. J. S. Hendy, Essex-street, Strand, butler. An improvement in the construction of chimneys and chimney pots.

681. J. Hunter, manager, Dalmellington Iron Works, Ayr, N.B. Improvements in apparatus for removing slag from furnaces.

686. H. Fletcher, engraver and mechanician, Market-street, Manchester. Improvements in cleaning and preparing cotton, and the machinery used for that purpose.

690. S. V. Bonneterre, C. T. Erhart, and J. P. Monti, 51 Rue de Malte, Paris. An improved apparatus for regulating the pressure of steam in steam boilers and the combustion in their furnaces.

694. S. K. Thompson, Coniston, Lancaster, engineer, and A. T. Thompson, Bolton-le-Moors, Lancaster, engineer, and S. Mawson, Bolton-le-Moors, Lancaster, surgeon dentist. Improvements in railway apparatuses for communicating between guard and driver, and for coupling and uncoupling the carriages, parts of which apparatuses are applicable to connecting pipes and tubes.

696. H. Fletcher, 82 Wood-street, Cheapside, warehouseman. Improvements in neck-ties, scarfs, cravats, and collars.

698. E. Bolton, Warrington, glass manufacturer. Improved apparatus for transferring liquid matters from one vessel to another.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

745. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. A new or improved means of arresting headstrong or runaway horses. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2854. T. Procter. Carriers or stackers.
2857. C. E. Wilson. Wearing apparel.
2861. H. Bird. Bottles.
2869. M. Wigzell. Nails, bolts, and screws.
2870. R. Heath. Umbrellas and parasols.
2881. J. Grint. Boots and shoes.
2884. M. Gibson. Reaping and mowing machines.
2886. D. Stewart. Hydraulic cotton presses.
2887. R. T. Worton. Pianofortes.
2881. J. Else. Washing apparatus.
2891. J. Hawkins. Bits.
2892. W. and E. Cliff. Manufacture of lace.
2894. F. C. Pactow. Raising and finishing fabrics. (A communication.)
2898. G. P. Bonneton and M. G. Prodon. Rolling metals.
2901. L. and M. Smith. Improving the quality of fermented liquors.
2903. T. Redwood. Sizing powder.
2919. E. Peyton and W. F. Batho. Pillars of bedsteads.
2932. W. Ambler. Loom pickers.
2938. E. Peyton and W. F. Batho. Supporting bedding and cushions in bedsteads.
2945. J. H. Johnson. Toothed wheels. (A communication.)
2972. C. Stevens. Anti-corrosive ink. (A communication.)
2975. W. Firth and R. Ridley. Working mines.
2976. J. H. Johnson. Supporting the womb. (A communication.)
2977. G. E. Donisthorpe, W. Firth, and R. Ridley. Working mines.
2979. J. Standfield. Steam engines.
3029. J. Burrows and J. Dougan. Driving drums or pulleys.
3108. W. H. Tooth and W. Yates. Manufacture of iron.
3216. A. and J. Edward. Spinning.
66. J. H. Tatum and W. J. Williams. Manufacture of cradles.
264. E. H. C. Moncton. Obtaining ammonia.
571. H. Bowen. Gas meters.
583. H. Bunning. Lubricating.
593. T Greenwood. Sewing machines.
598. W. and W. Hensman. Steam ploughs.
600. T. Bostock. Boots and shoes.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

LIST OF SEALED PATENTS.

Dated March 21, 1862.

2186. J. B. Fondu.
2371. H. Plantrou.
2382. T. Davey.
2383. C. Watt, J. Watt, and T. S. Haviside.
2384. J. Fawcett.
2392. R. A. Brooman.
2400. T. Bentley.
2402. J. Openshaw, W. Entwistle, and J. Lord.
2405. S. S. Robson.
2410. V. S. Léte.
2412. W. Clark.
2417. D. McCallum.
2426. D. Lane.
2429. M. Theiler.
2435. J. Lush.
2448. W. H. Payn.
2449. W. S. Hogg.
2453. J. C. Dicalson.
2476. E. T. Hughes.
2497. W. Squire.
2542. T. B. Collingwood and A. Butterworth.
24. E. Nugent.
80. W. Clark.
132. T. Newton.

Sealed March 25, 1862.

2317. J. Eastwood and J. B. Joyce.
2401. H. Nunn.
2415. G. Smith.
2421. G. J. Ganier and E. E. Collet.
2423. W. N. Wilson.
2425. J. Reeves.
2434. B. G. George.
2442. W. E. Matthews.
2444. O. O. Lesourd.
2460. E. Brettt.
2467. A. Law.
2499. A. Chaplin.
2507. W. Catford and S. Wheatley.
2508. H. Willis.
2512. I. Evans.
2519. J. Norman.
2539. A. English.
2588. T. Wild and I. Hodson.
2652. G. Davies.
3146. W. R. Rogers.
3172. M. Haaff
3256. G. H. Birkbeck.
61. J. Brunt.
234. T. Meriton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

691. R. Mushet.
692. A. L. Thirion.
702. J. Howden and A. Morton.
703. R. Mushet.
704. W. and S. Pickstone.
707. W. Haggett.
712. J. Roberts.
713. S. Leoni.
721. W. A. Gilbee.
722. W. Weld.
733. C. A. Watkins.
744. J. H. Johnson.
746. F. Tillett.
795. T. D. Shipman.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

625. Earl of Aldborough.
655. W. Brown.
671. J. Mariaud.
680. G. L. Torney.
700. J. Blair.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending March 15, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2018	0 3	2022	0 8	2026	0 7	2030	0 3	2034	0 3	...	–
2019	0 3	2023	0 3	2027	0 11	2031	0 4	2035	0 3	...	–
2020	0 3	2024	0 9	2028	0 3	2032	0 4	2036	0 6	...	–
2021	0 3	2025	0 10	2029	1 1	2033	0 3	2037	0 4		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, March 27, 1862.

		£ s. d.		£ s. d.
IRON:				
Rails in Wales and North of England	pr. ton	6 5 0	to	[illegible]
Welsh Bars, in Wales	„	5 0 0	„	[illegible]
Staf. Bars, at the Works	„	6 10 0	„	[illegible]
„ Hoops	„	7 10 0	„	[illegible]
„ Sheets, Singles	„	8 5 0	„	[illegible]
„ Nail Rods	„	6 15 0	„	[illegible]
„ Boiler Plates	„	8 0 0	„	[illegible]
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2 9 0	„	[illegible]
Do. No. 1, Good Brands	„	2 11 0	„	[illegible]
Scotch Bars	„	7 5 0	„	[illegible]
Swedish Bars, in London	„	10 10 0	„	[illegible]
COPPER:				
Sheet and Sheathing	per lb.	0 1 1½	„	[illegible]
Tough Cake and Tile	pr. ton	98 0 0	„	[illegible]
Best Selected	„	101 0 0	„	[illegible]
Australian	„	99 0 0	„	[illegible]
South American	„	0 0 0	„	[illegible]
Yellow Metal Sheathing	per lb.	0 0 8¼	„	[illegible]
STEEL:				
Swedish Keg	pr. ton	15 0 0	„	[illegible]
„ Faggot	„	16 0 0	„	[illegible]
TIN:				
English, Block	p. cwt.	6 1 0	„	[illegible]
„ Bar	„	6 2 0	„	[illegible]
Foreign, Banca	„	4 10 0	„	[illegible]
„ Straits	„	[illegible]		[illegible]
TINPLATES:				
Charcoal, I.C.	pr. box	1 7 0	„	[illegible]
Coke, I.C.	„	1 1 6	„	[illegible]
LEAD:				
Pig, English	pr. ton	18 10 0	„	[illegible]
„ Spanish	„	19 0 0	„	[illegible]
Common Sheet	„	21 10 0		[illegible]
Tea „ (Wimshurst's Patent) A special discount	„	35 0 0	„	[illegible]
SPELTER:				
On the spot	„	18 0 0	„	[illegible]
For arrival	„	18 5 0	„	[illegible]
ZINC:				
English Sheet	„	26 0 0	„	[illegible]
QUICKSILVER	pr. btl.	7 0 0	„	[illegible]

JAMES LAURIE, Metal Broker.
10 Old Jewry Chambers, E.C.

THE
MECHANICS' MAGAZINE.
LONDON, FRIDAY, APRIL 4, 1862.

THE ATLANTIC TELEGRAPH.

SURELY the time has arrived when another international effort should be made to unite Europe with America by telegraph. Science proclaims its possibility, commerce demands it, and humanity pleads for it. The Government of the United States of America has signified its disposition to co-operate in the great work, and a powerful company is willing to undertake its accomplishment. Why, then, should any more time be wasted? Why not commence without delay, when science, national interests, and the voice of civilization unite in saying the thing can and ought to be done? The answer is, that no efficient step can be taken without a guarantee from the British Government.

As a rule we do not think it is politic for governments to take any part in great industrial enterprises. We have had too much government action and control in trade and commerce, in education and religion; and of late years this country has grown great and strong in proportion as the Government has receded into its legitimate domain, and permitted the energies of industry and commerce to develope themselves without protection or patronage. We consider, however, laying down a telegraph between Europe and America to be an exceptional thing, as the Government and the people generally will be the principal gainers thereby. Such a telegraph would not be merely beneficial to the shareholders of the company, but to the people on both sides of the Atlantic. At the telegraphic *soiree*, held at Mr. Samuel Gurney's last week, Mr. Stuart Wortley said that, during the short time the Atlantic telegraph cable was in working order, messages of considerable value to the nation at large were transmitted from this country to America, and he believed that from £40,000 to £60,000 were saved by one message. Mr. Varley went so far as to say that he believed that England and the United States would be the gainers if they were called to go to the expense of laying down a cable every year. We consider that it cannot for a moment be doubted that did such a medium of communication exist when the unhappy Trent dispute commenced, the Government of England would not have considered itself justified in expending a shilling in preparations for a possible war. The lightning-winged message would have disarmed misapprehensions and quieted alarms. Not only would there be more money saved than would be requisite to lay a cable across the bed of the Atlantic, but angry feelings and irritating words which leave a sting behind, and which may embitter future disputes, would have been prevented. A cable constructed and laid down for pacific purposes, and in the interests of civilization, would plead for an amicable settlement of any dispute which might arise. Submarine telegraphs are amongst the best harbingers of peace on earth, and good will amongst men. Had no other message been sent than the sublime one which President Buchanan transmitted through the Atlantic telegraph to our Queen that telegraph would not have existed in vain. We regard, therefore, a means of telegraphic communication between England and America to be of primary national and international importance, and as especially deserving the encouragement of Government.

Even looking at the question in the most disadvantageous light, we should remain of the same opinion. If another cable were laid under the conscientious guidance of science, and if the contractors put forth every honest endeavour to complete the work, should the cable fail, it ought not to be supposed that all the money expended on it would be lost. Even then a fund of useful experience would be acquired for future use. Every new generation enters into the labours of its predecessors. Those labours might have been costly and painful, but they were the means by which successors might realize wealthy results. Many people point to the Atlantic cable as an unmitigated failure, and they speak as if all the money spent on it might as well have been thrown overboard into the bottom of the ocean. This is a mistake. We do not feel called upon to justify all that was done in laying that cable, but we say unhesitatingly that the knowledge obtained during the process of its manufacture and submersion, and the subsequent experience gathered from investigation suggested by the failure, are results of considerable value.

Is not the Government expending large sums of money every day for war purposes? A week or two since we recorded the destruction of a costly target at Shoeburyness. That target was constructed under the superintendence of Mr. William Fairbairn. The experimental trial took place in the presence of statesmen and men of science. Will any one say that, because Mr. Fairbairn's target failed, that all the money expended on its production was thrown away? Certainly not. That experiment demonstrated certain facts, and showed how certain errors might be avoided in future. It would be the same to some extent if a greater and more costly experiment were made to tie two continents together by telegraph.

Certainly, if we consider it our duty as a nation to spend so much money in preparing for possible wars, we can afford to be a little more liberal in promoting the arts of peace. Nobody can deny the vast advantages which daily accrue to this nation from the submarine cables which are now in daily operation. Let the Government conceive for a moment the inconvenience and the loss it would sustain if the telegraphs which unite this country to the continent were destroyed? It would consider itself thrown back almost into the dark ages. Considered in no other than a pecuniary light these telegraphs are of incalculable value. Let us then by all means extend the advantage, by bringing Washington and New York *en rapport* with Liverpool and London. We believe the thing to be possible. We believe that science has conquered the difficulties which stood in the way of the thing being done. We believe that contractors like Glass, Elliot, & Co. are penetrated with the honest conviction that they can make a cable good enough and strong enough to meet all emergencies. We have the best means of knowing that gutta-percha as an insulator can now be manufactured almost to perfection. It was not so when the old Atlantic cable was produced. Since that time, said Mr. Varley, at Mr. Gurney's *soiree* last week, so much have they improved in the process of manufacture, that a sheet of gutta-percha which would then be as opaque as paper would now, by superior manipulation, be almost as transparent as a pane of glass. Since the publication of the Commissioners' Report on Submarine Cables, we have taken some trouble to investigate the gutta-percha question, and we cannot find that the failure of a single cable is traceable to the inefficiency of that material. Important improvements have also been made in the method of constructing cables. We have also improved instruments and means of ascertaining the integrity of insulation. The American Government has signified its amicable intentions by offering to co-operate in any plan which the British Government, in its wisdom, may adopt. The American Government will guarantee the protection of the cable in the event of a war between the two countries. We have reasons for believing that the French Government would follow the example of the English Government. In fact, we do not see why every government in Europe should not act likewise. A successfully laid cable would not merely be a benefit conferred on England and the United States, but on America and Europe. It would be a blessing conferred on humanity.

Did we not honestly think that the possibilities of science, and the spirit of contractors were quite equal to the task, we would not say a word in its favour. Did we not think that all the probabilities tended irresistibly in favour of a successful issue, we would not advise the Government to advance or guarantee a single farthing. We are of opinion, however, that the Government will not be called on for any money. Sufficient capital, we are informed, can be raised for the required purpose. All that is asked from our Government is a small guarantee to the extent of one or one and a half per cent. on the capital for a certain number of years from the time the cable is laid.

The Government is lavish, we may say extravagant, in appropriating money in fortifications and ships of war. Large sums are granted annually for educational purposes. The national wealth is not stinted where the exigencies of the civil service are concerned. Why, then, should there not be some encouragement offered to a splendid project, which aims at diminishing the causes of war and in promoting the interests of nations. Lord Palmerston has frequently been called the "war minister," he has now an enviable opportunity of showing the world and posterity that he is not unmindful of the more enduring arts and interests of peace.

We have nothing to do with the interests of rival companies. We are wedded to no company, and we see no reason why more than one company may not be established. We have several times spoken favourably of the North Atlantic company, and we heartily wish it a speedy success. But we cannot blind our eyes to the fact that at the present time the preponderence of opinion is in favour of the Atlantic Telegraph Company, and we therefore expect that when the next great experiment is made, it will be under the auspices of that company.

INVULNERABLE FLOATING BATTERIES.

THE question of coast and harbour defences is settled. The MECHANICS' MAGAZINE has long been the unflinching advocate of floating batteries in opposition to detached forts at the entrance of rivers and harbours, and we heartily congratulate the country on the decision in favour of the former, which events, stronger than arguments, cannot fail to force on a reluctant administration. The two battles of iron against wood, and iron against iron have revealed the truth to the most sceptical. The sudden conversions in the Legislature, and in scientific bodies are marvellous. The leading journal has veered round. We are all now of one opinion. Wood and stone are condemned; iron is triumphant. It is not our intention to fight the battle over again; we did our duty when we stood almost alone, and are content to remain victors in the company of the iron monsters who so summarily have brought the contest to something like a close.

Our wish now is to turn this iron victory to the best account; and we propose to afford all the aid in our power not only to secure to the nation the most efficient system of invulnerable ships as floating defences and sea-going men of war, but to render this discovery of a new principle in warfare the means of a sweeping retrenchment of our enormous military expenditure. At the same time we rejoice at being able to express our conviction, that the course we intend to recommend will tend not only to alleviate the burden of taxation which presses so heavily on toiling industry, but to avert the horrors of war by rendering our maritime supremacy predominant over the combined powers of the old and the new world.

We are bound, in justice to a correspondent, whose letters no doubt have been read with interest, to admit that some allusions made by him to the danger of invasion of this country with fleets of invulnerable ships were suppressed, but not for the reason he supposes. We partook of his views to some extent, but we declined being the medium of raising a panic in the public mind, for we know that at the hour of peril England would be true to herself. We confess, however, we were not prepared for the sudden and dramatic confirmation of "A Civilian's" predictions which burst upon us last week.

The great fact is now before the world, floating structures can be made invulnerable, and we must—there is no help for it—adopt them for coast and harbour defences as well as for the command of the seas. However disagreeable it is to be proved in the wrong, we are convinced Government will yield with a good grace to the necessity, and we shall soon have the satisfaction of knowing that the stupendous fortifications, the unmeasurable extent and cost of which were only a few days back complacently made a boast of, will be abandoned. We are glad to see a motion is to be made in the House of Commons this evening, which will materially assist in the solution of the question. We shall consider it our duty to keep public attention fixed on the subject, and to trace out the course to be pursued, in order to secure to the nation promptly and efficiently all the advantages to be derived from this great revolution in naval and military tactics.

We assume that the means of attack and defence at home and abroad henceforth must and will be armour-plated vessels. It follows, that we must adopt the best systems of construction to render them invulnerable. But here we are all in the dark. The science is a new one, it is little understood, and our best authorities, scientific and practical, are at issue on every principle relating to the resistance of iron to artillery. To prove this we need only refer to the interesting discussions on iron ships which have lately taken place at meetings of scientific societies.

The *Times* says the subject is complicated by mixing up the two questions of harbour defences and armour-plated men-of-war. This argument is likely to draw off public attention from the former question, which becomes troublesome at head quarters. But there is no complication—the two questions form one whole, and cannot be separated. Both are based on the newly discovered principle—the construction of an invulnerable floating vessel. Any system of armour plating which is the best, will be alike applicable to floating batteries or to sea-going men-of-war. First, ascertain promptly and by actual trial the most perfect mode of making iron armour shot-proof. This being done, the system can quickly, and at comparatively small expense, be applied to wooden ships, which, being converted into impregnable batteries, will successfully repel any attacks on our harbours, arsenals, or dock yards. These will supersede detached forts and be more serviceable. This is the real question at the present moment. The "Naval architecture" question is another matter; *it* really is a source of complication, and requires time for its practical development. Experiments on modes of constructing iron armour can be made on shore, and at a small expense, but for combinations of speed and sea-worthiness, with fighting qualities, and tonnage to carry enormous weights above the load line, ships must be built and tried at sea, which involves a vast expense, and takes a long time. Happily we know that a *little* Monitor will keep a *big* La Gloire at bay, and we can extemporise a great many Monitors in a few months. We may want Warriors to fight great battles at sea, and attack an enemy abroad, but as we are not an aggressive people, and nobody will go to war with us if we are unassailable at home, let the Government, disregarding the advice of the *Times*, take time to determine the best mode of constructing iron-clad line-of-battle ships, suspend those costly experiments of Warriors and Achilles', and apply all its energies to provide for the defences of our harbours and roadsteads, by applying to the construction of floating batteries of the invulnerable class the money which would be wasted if expended on land forts.

Having directed some attention to the question, we are prepared with a suggestion, which we hope will be carried into effect. In our present state of ignorance the truth can only be got at by experiment, and we conceive it to be the duty of Parliament to utilise the stores of knowledge and means of research available in this country, for the organization of a system of experimental investigation on such a scale, and under such control, as shall render it effective. We propose the formation of an Iron Armour Experiment Commission, composed of the personal elements necessary to its success. The existing Special Committee on Iron would naturally be the nucleus of this Commission. Its members, six in number, are able men in their several professions, who are well qualified by the experience they have gained in the zealous discharge of their duty, for the office proposed to be assigned to them. The chairman, Sir John Dalrymple Hay, M.P., a captain of the royal navy, has for many years been a zealous advocate for an iron navy, is a thorough practical sailor, and has carefully studied the scientific problems relating to the sea-going and fighting qualities of an iron ship; Dr. Percy, F.R.S., the well-known professor of geology, requires no commendation on our part, there can not be a better authority on the chymistry and properties of metals; Mr. William Fairbairn, F.R.S., is a scientific engineer of well-known ability; Mr. William Pole, F.R.S., is profoundly versed in the practical details of the manufacture and strength of iron; Colonel Henderson, of the Royal Artillery, and Major Jervis, of the Royal Engineers, are officers of distinguished merit and sound practical knowledge in their respective professions. To these six gentlemen, for the completion of the proposed Commission, should be added a naval architect of reputation, one or two practical shipbuilders, a skilful manufacturing engineer, and, above all, one or two Civil Engineers of standing. A Commission thus composed, with the addition of some practical men of business, including an experienced shipowner, would master the correct bearings of any proposition brought before them. Their functions should be to examine and report upon any plans or inventions submitted to their notice, and to direct experiments to be made, under their inspection, of any system of armour plating selected by them for trial. They should have full power, within prescribed limits, to make such experiments as they think desirable, and for that purpose a sufficient sum should be placed at their disposal. In the choice of plans for trial they should be independent, but be bound to pay particular attention to any invention submitted to them by the Admiralty or War Office.

This Commission being purely for experimental purposes, would in no way interfere with the executive duties of any department. Its wholesome action and practical utility in exercising its own independent judgment, and conducting experiments on its own responsibility, would be the means of settling those numerous vexed questions of form and size of plates, of fastenings and backings, of combining advantageously the armour and structure of a ship, and other points on which opinions are so much divided. As an effectual guarantee for the judicious and faithful discharge of their duties, and the economical disposal of the funds committed to their charge, the Commission should be bound to report in every case their reason for refusing or making a trial. Even if the expenses of this Commission were somewhat costly, it would be sure economy in the end, and its proceedings could not fail to determine in a short time the best mode of constructing iron armour for ships, and rendering them as nearly as possible invulnerable.

We recommend this proposition to the notice of the Legislature. It will, if realised, relieve Government from the perplexing difficulties it encounters in the examination of new theories, in the choice of rival systems: it will be a sure guide to the truth. If brought before the House of Commons in the right spirit the measure will be carried, and the Commission being properly constituted, the public would begrudge no reasonable amount of money for a series of really useful experiments. Far better to carry out a comprehensive system of decisive and well considered trials promptly, than to go on spending hundreds of thousands in armour-plating ships on erroneous principles, without any previous trial.

SIR SAMUEL BENTHAM.

[SECOND NOTICE.]

BENTHAM, after his return to England, did the wisest thing possible for a man to do situated as he was, he at once commenced a tour of the manufacturing districts, and thus, so to speak, "took stock" of the material progress which had been made therein during his absence. He was surprised to find that in the twelve years which comprised that period, very little actual improvement had been effected. Hand labour was still largely employed in manufacturing processes, and steam-power was comparatively unknown among manufacturers. Stimulated by the opportunity which presented itself for effecting a reformation in these respects, Bentham lost no time in exercising the inventive faculties with which he was so largely endowed. His father had recently died, and his brother Jeremy had come into possession of the family mansion, in Queen-square Place, Westminster. The brothers were always on the most excellent terms, and the philosophical jurist willingly gave up to the practical inventor such portions of the paternal domicile as were suitable to the carrying out of his experiments. The outhouses were speedily converted into workshops, and Samuel was about to erect therein a small steam engine, for the purpose of giving motion to the various models and machines he intended to construct. At this time, however, the subject of prison discipline was one which occupied much attention, and Jeremy published a work upon it, entitled the "Panopticon, or the Inspection House." The propositions contained in this were considered by Mr. Pitt and other ministers of the day to be highly practical and valuable, and a model building was proposed to be erected on the Benthamite plan. General Bentham set himself to work in devising machines which it was intended the Panopticon prisoners should work, and he obtained an extension of his leave of absence from Russia for the purpose of completing under his own inspection those machines. Among these latter, were contrivances for "planing wood, sawing it in curved, winding, "and transverse directions, for preparing all "the parts of a highly-finished window sash, "and for forming those of an ornamental carriage wheel." In the working of these machines neither skill nor manual dexterity on the part of the workmen was necessary. Patents were taken out for them, and all promised fairly for the Panopticon scheme.

Some secret opposing influences, however, were at work, the plans of the two brothers were never realized, and at a later period, and at a much greater expense, the hideous Penitentiary at Millbank was substituted for the proposed Panopticon at Battersea Rise. Numberless inventions of minor importance were conceived and perfected in the workshops of Queen-square Place, but for particulars of these our readers must be referred to the volume in which they are chronicled. Matters of a much more weighty kind soon absorbed the attention of Bentham. The naval business of the country in its civil branch—his early love—had again absorbed his attention, and after some communications with the Lords of the Admiralty, he was authorized in 1795, "to visit His Majesty's "Dockyards, for the purpose of suggesting "improvements in them." This commission and the prospective results he expected to arise from it, induced Bentham—much against the advice of his friends—to relinquish his previous intention of returning to Russia. In that country he had attained the rank of Brigadier-General, and a gift of land and other honours he knew awaited his return to it. Patriotism outweighed all, however, and he determined hereafter to devote himself heart and mind to the service of his own country.

On the 29th of May, 1795, Bentham reported to the Admiralty on the state of Portsmouth Dockyard, the first he had officially visited, and offered suggestions for numerous improvements and alterations. The principal of them had reference to various docks in course of formation there, and these were reformed in accordance with his plans. Much advantage admittedly arose from the changes effected in this respect by the new Naval Inspector. Not only did he devote his attention to the formation of docks, and to increased facilities for building and repairing ships of war, but possessing very definite notions of the art of shipbuilding, he proposed sundry changes in the mode of constructing vessels. The Admiralty Board convinced of the justness of his views in this last respect, "authorised him to have constructed "seven small vessels upon his own individual "responsibility, and uncontrolled by any naval "board or dockyard officer."

In these days of iron ships, it is scarcely desirable for us to describe minutely the *modus operandi* pursued by him in the construction of his small wooden fleet. It may be said that the vessels comprising it were a satisfactory exemplification of the skill of Bentham as a naval architect, and that one important feature about them was the introduction of bulk-heads, forming water-tight compartments, a plan now all but universally adopted in the ships of our iron navy.

In 1796, the institution of the office of Inspector-General of Naval Works was sanctioned by the king in council, and Bentham was soon after regularly installed in that capacity. His duties were defined, but it will be seen from the following extract from the warrant appointing him, that they were also comprehensive:—"He "shall consider all improvements in relation to "the building, fitting-out, arming, navigating, "and victualling ships of war and other vessels "employed in his Majesty's service, as well as "in relation to the docks, slips, basins, buildings, and other articles pertaining to his "Majesty's naval establishments." Here was work enough looked out to satisfy the most industrious of men, but it was easy to perceive that the power which thus passed into the hands of the new Naval Inspector was likely to meet with some resistance from those who had previously been entrusted with the management of the various branches which in future he was to control. Several gentlemen were nominated as assistants to the new officer, and these, with one exception, on his own recommendation. Messrs. Bunce, Rehe, Peake, and Barr, constituted his staff, in the positions, respectively, of architect, mechanist, secretary, and draughtsman. Mr. Richard Upsall, who had served in the same vessel with Bentham during his three days' engagement with the Turks in the Black Sea, and who had much distinguished himself on that occasion, was appointed as clerk. Bentham's office soon became a scene of the most vigorous activity, and the variety of subjects which came under consideration was great indeed. In the midst of all, nevertheless, he found time for courtship and marriage, and the eldest daughter of Dr. George Fordyce was the lady he led to the altar. This event, in all respects a happy one for the parties concerned, took place in October, 1796. In January, 1797, it was in the contemplation of the Government to erect a prison for the "accommodation" of 10,000 prisoners of war. The Inspector-General was applied to, and quickly furnished plans for the structure. Means, however, were found for disposing of the prisoners among already-existing prisons, and the scientifically-designed building of the Inspector-General was not erected.

As a specimen of the prejudice and opposition which Bentham found arrayed against him, it may be mentioned that his proposition for the introduction of steam power into Portsmouth Dockyard was denounced by the authorities of that place as a useless, and dangerous one. It was urged that men and horses had hitherto answered all purposes, and that a steam engine would very probably *set fire to the establishment!* It was not only among the subordinate officials of the departments over which Bentham had control that hostility had to be encountered and overcome. At the Admiralty itself he found enemies, who were not particularly scrupulous in their modes of action, and these harassed and annoyed him considerably. For these and other obstructions to his career he was probably not unprepared; but those only who have experienced the effects of wanton and unjust aspersions persistently cast upon them, can comprehend the wearing and tearing anxiety to which their victims are exposed. "Constant dropping," the adage says, "will wear away a stone," and certainly constant slander will in time subdue its object, though the action be imperceptible.

He who seeks to reform abuses in Government departments must expect to meet with many impediments in his onward course, or at any rate, whether he expects them or not, they will assuredly present themselves.

Bentham's reports were carped at and criticised with considerable severity by some who were in positions of sufficient eminence to cause their adverse opinions to give him much trouble. The consequences of this strain upon the mental powers of Bentham, combined with his incessant application to business, were a serious fit of illness, and his withdrawal for a month from all official duty. On his return, the first point which drew his attention was the work in connection with the new dock in course of formation at Portsmouth. It had been proposed that the entrance to the basin, its apron, gates, &c., should be constructed in the ordinary and costly manner hitherto practised. He, however, proposed that the entrance should be of masonry, and the lower part in the form of an inverted arch, which, with its sides, should form a groove. For closing the entrance, he contrived a hollow floating dam, which should fit water-tight into the groove in the masonry. The interior of the dam was provided with valves, and by the admission or withdrawal of water, it could be sunk or floated. There can be no doubt that this arrangement was the parent of the "*caisson*" system, so largely adopted since in the construction of docks, and to Bentham, therefore, must be attributed its invention. Many other practical improvements in dock economy were carried out in the teeth of considerable opposition, at Portsmouth, and their effects are favourably visible there to this day.

In the spring of the year 1799, the first steam-engine introduced into Portsmouth Dockyard was set to work, and employed in pumping water. It broke down under circumstances which led to the supposition that it had met with unfair play. Soon after, all was put again into working order, and the feeling against steam gradually subsided.

In the year 1800, Bentham designed what is claimed for him as the first steam dredging machine, and in 1802 this was actually completed and set to work in the harbour at Portsmouth. We are aware that the merit of inventing this valuable machine has been assigned to others, but it is only fair to say that the authoress of Bentham's Memoirs has produced for the General strong evidence in favour of his claim thereto. It is a question of date more than of anything else, and possibly those who may conceive that undue praise in respect to the dredging machine is given to Bentham may feel disposed to dispute his right to the invention. At any rate our columns are open to controversy on the subject if such be desired.

In respect to Sheerness Harbour and Deptford Dockyard, Bentham furnished valuable reports which, however, were not acted upon, and, as regards the first, the celebrated Mr. Rennie was afterwards called in, consulted, and finally commissioned to carry out his plans of improvement.

It has been stated that Bentham was essentially a reformer, not in a political, but in a social and economical sense, and although his mind had been fully occupied during the past five years with the improvement of practical matters coming directly under his cognizance, yet he had never lost sight of the necessity for sweeping changes in the management of the civil branch of the navy. He had communicated with Lord Spencer, then first Lord of the Admiralty, and with *Lady Spencer*, on the momentous subject, and at length he determined to frame a new code of regulations, and submit them to the proper quarter for consideration. It is not possible for us to give even the main points upon which the Inspector-

General dwelt. It must suffice, therefore, to say that his Reform Bill was practical, comprehensive, and apparently well calculated to effect the objects aimed at, namely, efficiency combined with economy in the administration of the civil branch of the navy.

As a matter of course, the propositions of Bentham were met by a chorus of disapprobation from the supporters of things as they were, and the comptroller of the navy especially was loud in his denunciation of the whole scheme as visionary and absurd. The opposition was to a great extent successful, and there is no doubt that at the present moment many of the evils which Sir Samuel Bentham sought to remove are in flourishing existence.

In the loss of his assistant, Mr. Bunce, by death, in the year 1802, Bentham sustained a severe blow. Bunce had been a talented, honest, and zealous coadjutor, and those who are aware of the value of such characteristics well know how to appreciate the grief which overcame Sir Samuel on the decease of his right hand man. 1803 found the Earl St. Vincent—the Captain Jarvis of other days, and Bentham's early friend—first Lord of the Admiralty, and soon after, in company of his colleagues, his ordship paid visits of inspection to the Royal Dockyards. The question of introducing steam power on a much more extended scale into these establishments was one which occupied much of "my lord's" attention on these occasions, and of course the affirmative was strenuously urged by Bentham. With a view to the carrying out of the design, Bentham obtained permission to visit once more the manufacturing districts, and as companions on this occasion he had Mr. Brunel and Mr. Goodrich, the mechanist. The immediate result of this seven week's tour was a report by Bentham to the Secretary to the Admiralty, wherein he stated that he had "seen reason to be entirely "convinced that cordage of all descriptions, "from the smallest twine to the largest cable, "may be advantageously manufactured by "means of machinery, such as may be set in "motion by inanimate force."

It has been said that Mr Brunel accompanied Sir Samuel Bentham in his tour of inspection through the manufacturing districts, and although it seems scarcely fair to the former distinguished man to introduce his name thus incidentally only in our notice of the Memoirs before us, yet, the fact that, very recently, ample justice was done him in the pages of this Magazine affords some ground for consolation. As to the vexed question touching the block machinery at Portsmouth, our own opinion has been previously given, and without wishing to deprive Mr. Brunel of any of his legitimate laurels, we must here repeat that the principal merit pertaining to the invention of that machinery belongs to Sir Samuel Bentham. The Patent Office will, indeed, sustain this view, for the specifications of Bentham's early patents describe exactly some of the machines subsequently erected by Mr. Brunel.

In 1805, Bentham was induced to undertake a mission to Russia, for the purpose of persuading the Emperor to allow the building of ships in that country for the British navy. There are many reasons for supposing, however, that those who were most anxious for Bentham's departure, had other motives for their anxiety than the avowed ones of conferring honour upon him. His constant propositions for effecting reform, and his restless love of improvement were troublesome to the jog-trot officials above and around him, and they had grown tired of his company. To Russia, nevertheless, he went, and on his arrival at Cronstadt was well received by the commander of the fleet. On reaching St. Petersburgh, the illusions with which he had set out vanished. The promise of the Emperor to allow shipbuilding for the British Government to be conducted at Archangel was discovered to be a myth. A civil diplomatic reply to a very indefinite request on the subject was all that had been really obtained by the Home Ministry, and upon this very slight ground Bentham had been despatched to Russia. After a somewhat protracted stay in that country he turned once more towards home. After a tedious and dangerous passage, Harwich was reached, and there letters awaited him from his office. "The first he opened in"formed him that the post of Inspector-General "of Navy was *abolished*, and that in conse"quence of a recommendation of the Com"mission of Navy Revision, it was to be incor"porated with the Navy Board, of which he "was to be appointed one of the Commis"sioners." It was too palpable now that malign influences had been at work during his absence, and that those who durst not previously confront Bentham, had not scrupled to take advantage of his turned back, and to inflict a wound which could not be resented. After some remonstrances and expostulations, Bentham took his seat at the Navy Board, where fresh annoyances were in store for him. These did not prevent his perseverance in devising and effecting improvements, and indeed his temperament and talent were such that stagnation with him was impossible.

Up to the very close of his life, in fact, he was actively engaged in the pursuit of scientific investigations, and of practical inventions. The misfortune was that he filled a Government situation. There is no doubt at all that had Bentham been unhampered by that bane of active ingenuity—red tape, and enabled to give free scope to the vast powers of his mind, he would have made for himself a name as an architect and an engineer, second to few if any of that class which England has produced. As it is, it is impossible to read the unostentatious and truthful memoir which his wife and daughter have given to the world, without feeling that much injustice was done to Bentham by those who should have fostered and encouraged his efforts. He did the state much service. It cannot be said that the state requited him at all in proportion to his merits.

Sir Samuel Bentham died on the 31st of May, 1831, after an almost unprecedentedly active career, and left behind him a name untarnished as a rich heritage to his descendants.

We are conscious that many works of Bentham's have been omitted in our notice of his life, but as those works may justly be called "legion," our omissions will be pardoned, and the volume itself will supply them.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER. VI.

INVULNERABLE IRON SHIPS.

In the copy of my first letter the introductory part alluded to the departed glories of "wooden walls," and the coming triumph of iron, in terms, which in the exercise of a sound discretion, you thought too extravagant and romantic for insertion in the sober columns of a scientific journal. But the battle of ironsides across the Atlantic has realised my predictions with startling effect, and made it manifest that there was no exaggeration in the picture I drew of the extreme peril to which our maritime supremacy, is exposed. With your permission, I will restore the passages referred to as the appropriate text on the subject of "Invulnerable Ships," which it may be truly said, in accordance with the views so long and strenuously maintained in the Mechanics' Magazine, will produce a greater change in warfare than the discovery of gunpowder, and exercise more influence on the balance of power than any event in modern times.

If England is to maintain the proud pre-eminence she has held against the navies of the world for 200 years, she still must rule the waves. But "iron walls" must be her bulwarks. The days of wood are numbered. In a few years a timber ship of war will be as much an antiquity as a Grecian galley or a Roman trireme.

The best mode of constructing iron war ships, combining architectural strength and seagoing qualities with invulnerability, is the problem to be solved; it is the grand question with every maritime state, and concerns England most. The time has gone by for hesitation and doubt—our national existence is at stake. The formidable preparations and rapid progress of the French in the formation of an iron-clad fleet of enormous strength are indications our statesmen no longer affect to ignore. The Americans, in the midst of their great civil strife, devote millions to the construction of armour-plated ships, of which, judging from what they have done already, their extraordinary energy and promptitude of action, will in twelve months produce a larger fleet than we shall have afloat in double that time. Other powers are building vessels of the same kind.

This new engine of war has taken us by surprise. We are baffled in our policy of national foresight, which makes it a standing rule that England at all times shall possess a navy able to cope with all the navies of the world. In this sudden change of the game, wooden ships are swept off the board, and if we were suddenly involved in war we should be overmatched and overpowered in the battle of ironsides. Why should the fact be concealed? —the peril of England is great, and unless our Admiralty awake from their apathy, and cast off the dull spirit of routine which obstructs all progress, Government will assume a fearful responsibility.

Evil for England would be the day when an enemy's invulnerable squadron could steam into our ports and rivers, unassailable alike by our fleets or batteries. Our ships, if imperfectly protected with iron armour, would be destroyed, and our land batteries would be passed by unheeded. This danger is not so remote or imaginary as may be thought; it is great and menacing to the country, and with that conviction, I join with others in raising a warning voice.

The astute ruler of France is unremitting in his exertions to render his mail-clad frigates impregnable. If he attain his object, what will be the use of fortifications for the defence of our arsenals and dockyards? An unassailable fleet, if not beaten at sea, would pass them by with impunity. The only way to avert or meet this imminent danger is to adopt the most perfect system of encasing ships in armour, and to lose no time in constructing a sufficient number of these shot-proof floating batteries, to be able to station one or more at the entrance of every important harbour and river of the kingdom. These will be able to cope with an enemy at sea, to bar his approach to our ports, and give battle to his fleet with equal, if not superior, means of defence and attack.

But at the present moment we are miserably unprepared for this kind of warfare, and the preparations we are making for it, compared with the energy of those who may soon become our enemies, are lamentably slow. The Warrior

d by Google

twelve months the Institution had placed, or was about to place, fifteen new life-boats on the coast, viz., at Whitby, Selsey, St. Ives, Llanddwyn, Southport, Irvine, Campbeltown, Winterton, Great Yarmouth, Dungeness, Scarborough, Aberystwyth, Plymouth, Kingsgate, Blakeney, and Kirkcudbright. Others are in course of construction for Kingstown, Poolbeg, Howth and Dundee. New carriages and boat houses had been, or were being, built for all these boats. The Institution now possessed 120 life-boats on the coast of the United Kingdom, and one on the island of Guernsey. These boats had, during the year 1861, saved *two hundred and eighty-nine* persons from different wrecks, nearly the whole under circumstances of peril which could not have been encountered by any ordinary boats. The Institution had placed forty-five barometers at the different life-boat stations of the Institution. Attached to each barometer is a chart, on which the daily indications of the instruments are registered.

The total number of persons saved from shipwreck from the establishment of the Society in 1824 to the end of the year 1861, either by its life-boats, or for which it had granted rewards, was 12,272. During the past year the Institution had granted: 39 silver medals, 17 votes of thanks inscribed on vellum, and the sum of £1,287 14s. 2d. in pecuniary rewards for rescuing 416 poor creatures from shipwreck on our coasts. Since its formation it had expended on life-boat establishments £57,000, and had voted 82 gold and 705 silver medals for distinguished services. The total receipts of the Institution during the year 1861 had been £15,092 10s. 10d. Mrs. Hartley, of Bideford, had continued her indefatigible exertions on behalf of the life-boat cause, and had collected altogether £410, to be appropriated in aid of the cost of the Dundee life-boat and the Braunton life-boat house. The committee expressed their acknowledgements to the Newbiggin Branch, and other friends of the Institution in Northumberland, for their valuable co-operation in holding, last summer, a bazaar at Newbiggin in aid of its funds, the net proceeds of which realized the large sum of £300. The town and neighbourhood of Ipswich had also contributed nearly £500 to defray the entire cost of a life-boat station, through Mr. W. Bateman Byog, of the firm of Messrs. Ransomes and Sims, of Ipswich.

PRELIMINARY NOTE ON THE PRODUCTION OF VIBRATIONS AND MUSICAL SOUNDS BY ELECTROLYSIS.

By George Gore, Esq.

If a large quantity of electricity is made to pass through a suitable good conducting electrolyte into a small surface of pure mercury, and especially if the mercurial surface is in the form of a narrow strip about $\frac{1}{8}$th of an inch wide, strong vibrations occur; and symmetrical crispations of singular beauty, accompanied by definite sounds, are produced at the mutual surfaces of the liquid metal and electrolyte.

In my experiments the crispations and sounds were readily produced by taking a circular pool of mercury from 1 to 3 inches in diameter, surrounded by a ring of mercury about $\frac{1}{8}$th or $\frac{1}{10}$th of an inch wide, both being contained in a circular vessel of glass or gutta-percha, covering the liquid metal to a depth of about $\frac{1}{4}$ an inch with a rather strong aqueous solution of cyanide of potassium, connecting the pool of mercury by a platinum wire with the positive pole of a battery capable of forcing a rather large quantity of electricity through the liquid, and connecting the ring of mercury with the negative platinum wire. The ring of mercury immediately became covered with crispations or elevated sharp ridges about $\frac{1}{10}$th of an inch asunder, all radiating towards the centre of the vessel, and a definite or musical sound was produced capable of being heard, on some occasions, at a distance of about 40 or 50 feet. The vibrations and sounds ceased after a short time, but were always reproduced by reversing the direction of the electric current for a short time, and then restoring it to its original direction. The loudness of the sound depends greatly upon the power of the battery; if the battery was too strong the sounds did not occur. The battery I have used consists of 10 pairs of Smee's elements, each silver plate containing about 90 square inches of immersed or acting surface; and I have used with equal success six Grove's batteries, arranged either as 2 or 3 pairs, each platinum plate being 6 inches long and 4 inches wide. If the cyanide solution was too strong, the sounds were altogether prevented.

Being occupied in investigating the conditions and relations of this phenomenon with the intention of submitting a complete account of the results to the notice of the Royal Society, I refrain from stating further particulars on the present occasion.—*From the Proceedings of the Royal Society*, April 11, 1861.

FILES MANUFACTURED BY MACHINERY.

On Thursday last week, a large number of gentlemen assembled at the opening of the works of the Patent File Manufacturing Company (limited), Lime Bank-street, Ashton Old-road, Manchester. Amongst the gentlemen present were the Mayor of Manchester (T. Goadsby, Esq.), Dr. Fairbairn, Alderman Curtis, Mr. T. Jessop, Sheffield; Mr. S. Moore, Liverpool; T. B. Lurton, Sheffield; M. W. Matthews, Sheffield; Mr. Samuel Jackson, of the firm of Camol and Co., Sheffield; Mr. Asa Lees, Oldham, Mr. John Latham, Rochdale, and Dr. John Kirkman.

The works of this Company are the first in England in which files have been cut and perfected by machinery. Mechanicians and inventors have, for nearly two centuries, been endeavouring to attain this end. From the time of Prince Rupert, who patented an improved method of manufacturing files in the year 1671, down to 1860, no less than 45 or 50 patents have been taken out in England alone. The patents owned by the company are the two known as "Preston and MacGregor's" and one as "Francis Preston's," for forging, cutting, and shaping files. The Works cover a considerable space of ground, and several buildings, which form a square, are traversed by a tramway throughout. The visitor, after entering the central gateway, turns to the right, and passes through the steel store-room to the smithy, where the application of machinery to the manufacture of files is at once brought into operation. Here Ryder's patent forging machines are in use, together with a rolling machine, patented by Mr. Preston, seven years ago, for rolling and fluting bayonets, and which has now been adapted to the rolling of half-round and other files. From this room we pass to the annealing and softening department, where the processes employed are upon the most improved principles, but call for no special mention. In the grinding-room the files are prepared for cutting, by means of twelve Oddy and Oldfield's grinding machines. When they have undergone this process they are forwarded to an intermediate store-room, and thence to the cutting-room. The machine-cutting room is, of course, the department of the works to which the greatest amount of interest attaches. The machines occupy one side, and are erected on solid stone. In the two patents of Preston and Macgregor, already mentioned, it was found that the speed of the hammer was too slow, as not more than about 160 blows per minute could be given; besides which drawback, the regularity of the teeth caused the files to have a series of parallel grooves, which has always been regarded as more or less objectionable. To obviate these two defects Mr. Preston, after experiments extending over a space of three years, succeeded in effecting what had for nearly two centuries baffled the efforts of his predecessors, and in producing the machine in its perfected state as we now have it. This machine appears, to a casual observer, heavier and more massive than its purpose apparently demands; but the reason why so much weight is required is obvious, when it is perceived that the machine has all the movements of the human hand and arm from the elbow, even to imitating the sinews of the wrist. By this mechanism a slight elasticity is given to the chisel, though the latter is rigidly held in an iron holder, which accommodates itself to any uneven surface that the file may present. The ram and chisel holder on these machines work parallel to each other, and not from opposite centres as is ordinarily the case. The ram lifted by the cam, in lieu of a hammer, is not claimed as a new invention. The improvement and advantage consists in the adaptation of the ram to the peculiarly constructed chisel holder. As regards the article produced, the fault previously alleged against machine-made files has been effectually removed by this latest patent. The machine gives a zig-zag or wavy surface to the teeth, and thus completely imitates the appearance of the hand-made file. When the work effected in the cutting-room is completed, the files are passed into the hardening-room. They are here subjected to a process recently introduced, namely, immersion in a bath of red-hot lead. By the old plan of heating on the open fire, there was always a danger of over heating, which, as is well-known, is exceedingly detrimental to steel. This is prevented under the new method—the lead cannot be overheated—or if it should be, the crucible or retort would melt and scatter the contents on the floor. After the hot lead bath, the files are immersed in salt and water, then scoured and oiled, and finally transmitted to the warehouse, where a practical and experienced workman tests and examines each separately before it is packed. Machine-made files have an admitted superiority over those made by hand, because the whole number of teeth are equal in depth, and consequently the whole face of the file is available for use. In hand-made files, on the contrary, it often happens that a series of the teeth are more prominent than the rest, and these when worn down, form a smooth surface, and prevent the other being used. The advantages claimed for the machine-made files are not merely hypothetical or supposititious; some of the largest and most respectable engineers and machinists in the kingdom have practically tried the machine-made files, and have borne testimony that they do more work, and better work, and last longer than hand-made files.

After having passed some time in examining the different processes of manufacture carried on in the works, the gentlemen assembled in the warehouse room, in which an excellent dinner was provided for the company by Messrs. Jennison. Mr. Thomas Burtoo, jun., presided, and Mr. John Hodson occupied the vice chair. After dinner the usual loyal toasts were proposed. In responding to the toast of the Mayor and Corporation of Manchester, the Mayor said he was much gratified to see a new branch of industry being developed in Manchester. He believed that the company were doing a great work, and he wished them all prosperity.—Dr. Fairbairn proposed "Prosperity to the Patent File Machine and File Manufacturing Company, Limited." He said that during nearly a century he had exercised the profession of a mechanic and engineer, and during the whole of that period he had never been more gratified, than he had been that day in seeing the machines of the company at work, performing what had been done by hand for centuries back, and in a manner equal to that done by the human hand. They were all greatly indebted to the gentlemen who had formed that company. He had no doubt of the success of the invention, and hoped in a few years to see it flourishing in a manner that would be satisfactory to all present. He was quite satisfied that the gentlemen present from Sheffield would not be doing their duty to that town if they did not bring file manufacturing machines into use. It was a striking example of the power of machinery that the machines for making the files were capable of performing the wave motion in the same way as the human hand did; though he did not think there was any superiority in the files which had the wave.—Mr. Preston, in responding to the toast, gave some account of his invention of the machines, and said that the company, in the first instance, had only intended to manufacture the machines for those in the file trade at Sheffield. Three years ago a deputation from Sheffield, consisting of the mayor, ex-mayor, master cutler, and several leading houses in the trade, came over to Manchester to see the machines, and before they left they did him (Mr. Preston) the credit to say that the files produced were equal to any made by hand cutting in Sheffield, but at the same time had the manliness to say that there was not a house in Sheffield would buy a machine, for a reason which need scarcely be mentioned—(the opposition of the working men). The files produced by the machinery were both cheaper and better than those made by hand.—Mr. Jewsbury, the secretary, also responded to the toast, and gave an account of the satisfactory position of the company.—Other toasts, including "Success to the file trade," "Engineers and machinists," and the "chairman" and "vice-chairman" followed.—Alderman Curtis, in responding to the toast of the "The engineers and machinists," said he was of opinion that the last invention introduced by the company, by which the wavy appearance of hand-made files was obtained, was a great advantage, and would in his opinion tend to the success of the company. The company consists of 80 shareholders, chiefly engaged in the machine trade. The capital embarked is £20,000, and 100 women and boys have found employment in this new branch of manufacture.

THE WARRIOR'S SAILING QUALITIES.

At the opening meeting of the Institution of Naval Architects held last week at the hall of the Society of Arts, Mr. E. J. Reed, the secretary, announced that he had received a letter from the Hon. Captain Cochrane, in command of Her Majesty's steamer Warrior, accompanied by a chart or diagram of a perfectly novel kind, in which what might be called a complete scientific record of that vessel's voyage to Lisbon and Gibraltar and home again was set forth. Mr. Reed stated that the paper had been placed in his hands only a very few hours before the meeting assembled, and that he had consequently had no time to give it a detailed examination, or to extract from it those valuable facts which it manifestly contained; but he had found opportunity for examining it sufficiently to discover that it was by far the most perfect and important record of a steam voyage that had ever been brought to the notice of a scientific man. This statement was made not alone on account of the variety and exactness of the information which it afforded, but also because a very remarkable amount of scientific acumen and judgment had been brought to bear upon the methods of record which Captain Cochrane had introduced into it. The diagram consisted substantially of three sets of facts. First, those which related to the state of the wind and sea at every point of the ship's progress; secondly, those which concerned the ship herself, especially as regarded her behaviour; and, thirdly, those which depended upon the performance of the engines of the ship. Under the first head are recorded from hour to hour throughout the entire voyage the force of the wind, and its direction relatively to the ship's course, the atmospheric pressure indicated by the barometer, and the direction and amount of the sea's swell. Under the second head are given the draught of water, displacement, and midship section of the ship, the speed at which she went, the sail which she had set, and the duration and extent of her pitches, rolls, and lurches. Under the last head Captain Cochrane states the quantity of fuel consumed, the number of boilers at work, the grade of expansion to which the slide links were set, the actual indicated power given out by the engines, the number of revolutions made by the screw, the proportion of coal burnt per horse-power per hour; and the miles run per ton of coal under all circumstances. These various facts, which are of vital importance in a scientific point of view, and by no means unimportant in their bearing upon the economical working of our immense navy, are brought together in so ingenious and perfect a manner in Captain Cochrane's diagram that all of them may be ascertained at a single glance for every hour throughout the entire voyage to Gibraltar and back. There can be no doubt, as the Secretary observed, that if the Admiralty could secure records like these from officers in command of our sea-going ships, and would liberally sanction, as they have done in this case, their communication to such professional persons as were then assembled, most valuable results would speedily follow. It may, perhaps, be doubted whether some of our naval captains would be competent even to imitate the work which Captain Cochrane has so ably and laboriously initiated; but there are many by whom the task would be speedily mastered, and others would gradually fit themselves for it when they knew the Admiralty were anxious to see it done. It may be interesting to mention that, from Mr. Reed's explanatory statement, it appeared that the Warrior rolled or lurched worst on January 24, when entering the Bay of Biscay, where she met with exceedingly heavy rollers nearly a-beam, and a head sea. The greatest angle through which she lurched on that day was 39 deg., measured from the extremes. This was at 7 o'clock in the morning, and she continued to lurch through angles exceeding 30 deg. at intervals until 12 o'clock, the rolls being measured in all cases by a clinometer placed 20ft. 6in. before the foremost sternpost, and 3ft. 6in. below the upper deck. It was even stated by some on board that the ship inclined three several times on this 24th of January through angles exceeding 39 deg.; but the correctness of the observations in these cases is doubted. On the homeward voyage no such extreme rolling was experienced, the greatest inclinations then attained being 17 deg. to port and 6 to starboard on one occasion, and 10 to port and 15 to starboard on another. It should be observed, however, that the time of rolling, taking the worst days on the outward and homeward voyages respectively for comparison, did not vary greatly, the average oscillation being in the former case 6·5 per minute, and in the latter 6·25. The average number during the whole outward voyage was 6· ; during the homeward, 4·77. The indicated horse-power developed by the engines of the Warrior on the trial trip at Portsmouth was 5,471·4, but the greatest ever developed during the trip to Gibraltar and back was but slightly over 3,000, and this was kept up for a very short period only, showing that on an experimental voyage it is not thought desirable even to approach the circumstances of a trial trip at the measured mile. It is highly satisfactory to learn, however, that, even when unassisted by her sails, the good ship several times approximated towards the speed produced at the measured mile, which was 14.35 knots. On leaving Lisbon for Gibraltar, for example, with all sails furled, she ran at more than 13 knots for nearly a day, and part of the time actually exceeded 14 knots. These are the kinds of facts with which Captain Cochrane's diagram abounds, and they are recorded, not loosely, or in a written report, but in a rigidly scientific form, and without colouring or modification of any kind. Both the officer who recorded them so carefully, and the Admiralty who permit their publication, certainly deserve great credit. It should be added that Captain Cochrane has appended to his diagram a track chart of the voyage, in order that the ship's position at any period of it may be known, and a figure showing the deviations which the ship's compass underwent as she proceeded to sea and back again. He even heeled the ship over when in port, in order to determine the effect which her inclination exerted upon the compass, so that no pains should be spared to make the record complete. As the brief letter in which Captain Cochrane submitted his diagram to the institution contains an important and characteristic expression of opinion concerning the general qualities of the Warrior, we will add it here. It is addressed to the Secretary, and is as follows:—

"March 26.

"Sir,—I have the honour to state that the Lords Commissioners of the Admiralty have allowed me to forward to the Institution of Naval Architects the enclosed diagrams, which I hope may prove interesting, relative to the cruise of Her Majesty's ship Warrior; and I cannot refrain from taking this opportunity of mentioning that the Warrior behaved nobly in the severe gales and heavy sea she encountered, and that on her return to England she had sustained no damage, and was perfectly ready to proceed on active service to any part of the world.

"I have the honour to be, your obedient servant,
"Arthur A. Cochrane.

"To E. J. Reed, Esq., Secretary, Institution
of Naval Architects, &c."

Sir J. Pakington read a letter, handed to him by a friend and written by Commander Tyron, of the Warrior, in which the ship was spoken of in the highest terms.

A correspondent—an old soldier—states that the pensioners in Chelsea Hospital receive only one penny per day allowance for long and active service, and perhaps severe wounds. The stipend is ridiculously small, and hence many who have fought their country's battles prefer the Union workhouse to the Military institution.

MANUFACTURE OF ARMOUR PLATES.[*]

That the British Navy must be reconstructed by the substitution of armour-plated ships of war for its old wooden walls is now universally admitted. It becomes, therefore, a most important question, what is the best method of manufacturing the armour plates? This subject was first brought under the consideration of the writer when the Thames Iron Works Company received the order for building the Warrior, and it became a question with the firm whether they should erect steam hammers for the purpose of forging, or increase the power of their mills for rolling the plates. At that period, after careful consideration, the conclusion was adopted, that the plan of hammering would produce the best results, and subsequent experience has, in the opinion of the writer, fully borne out that view. That the best material for these plates is iron, appears to be established by all the experiments which have been made; many trials of plates of homogeneous metal or steel of various descriptions have shown that, although thin steel plates have resisted shot better than iron ones, when the thickness was increased beyond ¾-inch there was visible inferiority, and the thicker plates altogether failed.

Two qualities of the iron appears to be of prime necessity—toughness and solidity. If the iron is hard and brittle, it is easily cracked and broken by the shot; if unsound, either from blisters or lamination arising from imperfect welding, the power of resistance is proportionately diminished. It has been conclusively proved that any given thickness of iron, if composed of layers of thin plates, has very little resisting power in comparison with the same thickness of solid plate; and a plate apparently solid, but imperfectly welded, exhibits the same weakness.

The process of rolling plates 4½ inches thick has been described by the head of the eminent firm of Messrs. Brown and Co., of Sheffield, in a paper read by him at the Institution of Mechanical Engineers, Birmingham, as follows:—Bars 12 inches broad 1 inch thick are first rolled; five of these are then piled and rolled into a rough slab; two of these slabs are rolled into a plate 1¼ inch thick; four of these plates are then piled and rolled into a plate 2½ inches thick; and finally four of these 2½-inch plates are piled and rolled into the finished plate. The hammered plates manufactured at the Thames Iron Works are made in the following manner:—Scrap iron of the best description is carefully selected and cleaned, piled, hammered into a bloom, and then rolled into bars 6 inches broad, 1-inch thick; these bars are cut up, piled, and again hammered into a slab; several of these slabs are put together, heated, and hammered to the form required, and this process being repeated, the plate goes on gradually increasing to the length required.

In the manufacture of the best hammered plates, there is no mystery: it depends simply on the selection of the best material, and the employment of the most skilled and careful workmanship.

The writer confidently believes that scrap iron, rolled and hammered as before described, is decidedly the best material, and superior to any description of the puddled iron from which all the rolled plates are understood to be made. That the toughness of iron is dependent greatly upon the amount of working it undergoes, cannot be doubted. This working has already been given to a great extent to scrap iron, and the process of rolling it into the 6-inch bars, which are the raw material of the future plate, gives it a degree of toughness and fibre which it appears to retain through all the subsequent heating and hammering.

The tendency of hammering to harden does not take away this toughness, and the process of annealing restores much of what is lost. Numerous experiments on single plates which have been fired at, and close observation in the drilling, planing, and bending of the large quantities of plates which have been hammered in this manner, have shown that the brittleness which has been attributed to hammered iron is entirely avoided, and that the toughness of the iron is superior to that of the best rolled plates which have hitherto been produced. Solidity and freedom from blisters or lamination is unquestionably more certain in the hammering process; and when it is considered that to produce a rolled plate 160 thicknesses of iron must be perfectly welded at every point throughout the finished plate, under penalty of there being lamination, the frequent occurrence of this evil would seem to be inevitable; the presence of dirt between any two layers, or the failure to reach a welding heat in any part of the centre of the large masses which have to be dealt with, being certain to produce this fata result.

---

[*] Paper read by Captain J. Ford, at the Institution of Naval Architects, March 27th, 1862.

It must also be remembered that as the hammered plate is gradually built up of the slabs before described, a comparatively small portion of the mass requires to be placed in the furnace and heated at one time, while in the rolled plate the final pile, 10 inches in thickness and weighing six or seven tons, must be brought to a welding heat at once, and the operation of rolling completed before this heat is lost. To obtain this heat throughout the mass without burning the edges most exposed to the fire can hardly be counted upon as a uniform result, and when this has been accomplished, and delay in dragging it from the furnace, getting it to the rolls, forcing it between them, and completing the rolling process, will spoil it, and the loss, even of a few moments, may be fatal to the success of the operation.

These difficulties, of course, increase with the thickness and weight of the plates: the foregoing observations are made with reference to plates 4½ inches thick, such as are on the sides of the Warrior and her companions; but when, as in the case of the Minotour, and her sister ships now building, the thickness of the plates is increased to 5½ inches, it may well be doubted if these difficulties can be successfully overcome in the rolling process.

It will not, perhaps, be out of place, to refer to the return made to an order of the House of Commons, dated May 17th, 1861, of the mode of manufacturing the armour plates of the Warrior, and three of her companion ships, and the number of plates condemned in the process of manufacture, with the reasons for their condemnation. The Warrior's plates, about 950 tons, were all hammered, and only five plates proved faulty in the process of manufacturing. Of the plates for the Defence and Resistance, together about 1,200 tons, all but six were rolled; 45 were condemned for being blistered, laminated, or over-heated; and of the plates for the Black Prince, 950 tons in all, of which above 100 tons were rolled, and the rest hammered, 10 rolled plates and 32 hammered plates were condemned. It is to be observed, however, that in the manufacture of the hammered plates for the Black Prince, the whole operation was performed under the hammer, and the process of rolling the initial bloom into 6-inch bars was omitted. It is understood that in the hammered plates which have failed comparatively under trial, this preliminary rolling has not been adopted, and to this, to some extent, their failure to stand the test may be due.

The experiments made at Shoeburyness by the Plate Committee on plates of various thicknesses, and upon the Warrior and other targets, have not yet been reported on by the Committee, but it is understood by the writer, who by the courtesy of the Committee has had the opportunity of observing many of the experiments, that those manufactured as described at the Thames Iron Works have exhibited uniform and superior excellence, which has also been exemplified in all the trials of sample plates selected by the Government officers, and fired at at Portsmouth.

The attempt has recently been made to effect a combination of the two processes of hammering and rolling; the slab 10 inches or thereabouts in thickness being forged under the hammer, then heated *en masse*, and rolled in the same manner as the pile, forming the final process described for the rolled plate. To this the writer objects, that this plan involves the serious difficulties already adverted to as consequent on the heating and rolling of so large a mass. Thus far experiment confirms this opinion, as the plates manufactured in this manner have proved under trial greatly inferior both to the rolled plates and those hammered at the Thames Iron works.

In the minor qualities of smoothness of surface and uniformity of thickness, it may be observed that the hammered plates are quite equal to the rolled, and with respect to cost of production up to the thickness of 4½ inches, the market price of hammered and rolled plates is the same; but if the thickness and weight be increased, the cost of rolling will, without doubt, be seriously enhanced, while that of hammering will remain but little, if at all, altered,

THE ARMSTRONG GUN.

[From the *Engineer*.]

Reports have reached England of a novel naval engagement on the other side of the Atlantic, in which an iron-plated steam frigate first demolished a couple of wooden sailing ships of war, and was afterwards beaten off by another iron-plated craft which came up in the very nick of time. From the accounts it appears that the heaviest smooth-bore ordnance, to wit, 9 in. and 11 in. Dahlgren guns, were necessary to make any impression upon the iron plates with which the Merrimac was covered, while none of her guns inflicted the slightest injury upon her antagonist, the Monitor. The results of this contest are likely to hasten the adoption of iron plating on the sides of fighting ships in the navies of all naval nations. The wooden ships have been proved to be as vulnerable as old packing cases, to say nothing of the danger to which they are exposed from shells filled with melted iron. Taking it for granted, therefore, that every Government having a navy to maintain, will resort to plated ships, how shall we provide ourselves whenever we may be compelled to fight them? We can do nothing with rifled guns, at least with those at present in the service. It has been conclusively proved, by a great many experiments, that neither the so called Armstrong nor the Whitworth gun are of the slightest use when fired against 5 in. plates, especially if the plates be inclined. This fact was particularly verified the other day in the attack upon the plated target at Shoeburyness. The Armstrongs, too, have had wrought-iron shot which do not break up even after they have done all the work of which they are capable. The heavy smooth bores, say the 68-pounder 95 cwt. guns, are the only ones in the service which have succeeded in perforating a 4½ in. or 5 in. iron plate of good quality. The majority of the public have found it difficult to understand how it is that a rifled gun which can throw a shot four or five miles, has less destructive effect at short range than an old-fashioned piece which cannot throw two miles. But, while actual experiment has left no room for doubting the fact itself, it is one which, after all, admits of a ready explanation upon the established principles of gunnery and projectiles. By a simple contrivance known as the ballistic pendulum, the initial velocity of cannon shot may be easily ascertained, the motion imparted to the heavy mass of the pendulum by the impact of the shot fired against it, together with the relative weights of the pendulum and shot, being all the *data* requisite for calculating the velocity of the latter. Thus ascertained, the initial velocity of the heavy Armstrong shot has been found to vary from 1,000 ft. to 1,200 ft. per second, while that of the 68 lb. shot, fired with 16 lb. of powder from a 95 cwt. gun, is something over 2,000 ft. Now the actual forces contained in moving bodies are as the squares of their velocities, and were it possible to provide a vacuum in which to fire the shots in question, the round shot would have nearly four times the force, and, therefore, nearly four times the range of that fired from the Armstrong gun. But in the open air, the round shot, at a high speed, encounters a nearly four-fold greater atmospheric resistance upon every square inch of its disc than the pointed shot, while also the former has, perhaps, double the area of disc opposed to the air. Hence the velocity of the round shot rapidly falls off on leaving the gun, and thus, although having great destructive power at short range, its force is spent after a flight of perhaps one, perhaps two miles. These facts are as well established as anything in practical science, and yet we have abundant reason for believing that they are altogether unknown to many of those who should be most familiar with them. The results of practice will at last, however, convince those whose perceptions are alive to no other evidence, and we may at last find the War Office acting upon the belief that, for fighting iron-plated ships, rifled guns are hardly better than pop-guns. At long ranges all guns are equally useless in attacking plated ships, while the vessel which goes armed only with them to bowl away at distant wooden men of war will have nothing with which to cope with more formidable enemies alongside. That any guns in use in the British navy can crush in thick iron plates, especially if inclined, is doubtful, but, if there be any, it is the smooth bore only. Thus far the Admiralty have wisely provided the old 68-pounders for most of the new frigates for which 100-pounder Armstrongs were first contemplated. The Hector, however, building at Glasgow, and which is to have 24 of the former description of gun on her main deck, is also, it appears, to have 6 of the 100-pounder, 82 cwt. Armstrongs, in the same position. The *Times'* naval correspondent thus comments upon this decision, which, we may perhaps hope, may yet be reconsidered:—

"It will be observed that while no mention is made of guns for the upper deck six 100-pounder Armstrongs are fixed as part complement for the main deck, notwithstanding that past experience proves that Armstrong guns, from their breaking of breech pieces, and consequent escape of gases and explosions abaft, are unsuited for a ship's main deck. In fact, a strong feeling exists among naval officers that the Armstrong guns, with their present complication of parts behind the chambers, and the present imperfect mode of closing the breech, are unsuited for naval service, except when placed on a ship's upper deck, where they may be useful for purposes of chase, or throwing a projectile a long distance, and where, should an explosion take place, the broken breech and gases may escape into the air overhead, and thus lessen the chance of injuring the gun's crew. So far is this feeling acknowledged that provision is being made in the drawings for the shields of Captain Cole's ship for the substitution of the 95 cwt. smooth-bore gun for the 100-pounder Armstrong, should the closing of the breech of the latter continue in the same uncertain state as it is at present."

Considering that the *Times* lately declined to publish Captain Halsted's reply to Sir Wm. Armstrong's monster puff of the productions of his Elswick establishment, on the plea of the editor that it was impolitic to say aught to shake the confidence of the sailors in a weapon with which so many ships of war were already provided, we are pleased to see, in the columns of our contemporary, such a candid admission as we have just quoted of some of the notorious defects of the gun in question. It is not long, either, since the *Times* informed its readers that three of the 100-pounder Armstrongs broke down together on their first trial, and it might have added that of eighteen 40-pounders from the same maker lately tried in a batch, eight failed on the spot. It might have added that £10,000 worth of condemned steel "vent pieces," or breech-pieces as they really are, are lying at Woolwich, that £20,000 worth of Sir William's round-end lead-coated 100-pound shot have gone irretrievably to the bad, and that of the four descriptions of fuses which that gentleman has turned out, every one has signally failed, the *Times'* columns containing the obituary, the other day, of an immense lot of the "pillar fuses," the last improvement which our great military engineer has produced. It might have added that Sir William has now completely abandoned his breech-loading system for large guns, having fallen back upon a muzzle-loader, which he calls a shunt, notable for great cost and excessive windage.

Thus we are going on with our guns. While the French are rifling their cast-iron guns with advantage, our Government is sending back its best cast-iron guns to Lowmoor, receiving for them, as old iron, only as much per ton as is paid for shot. Surely when shot of the best iron are so much needed, these guns might be kept for that purpose. The Carron guns were lately being sent back to Scotland; but the virtue of their iron at length saved them from the cupola, the War Office having issued an order that no more should be sent away from Woolwich. The public may yet learn that some of the great number of Armstrongs now on hand are to be sold for old iron and that better guns for naval purposes will again be ordered from Lowmoor and Carron.

MEETINGS FOR THE WEEK.

Mon.—*Royal Inst.*, General Monthly Meeting, at 2 p.m.
Medical Soc., at 8.30 p.m.
United Service Inst., "The Disembarcation of Troops," by Captain W. R. Mends, R.N., at 8.30 p.m.
Soc. of Engineers, Discussion on Mr. Parsey's paper "On Trussed Beams," at 7 p.m.
London Inst., "On Birds," by R. Owen, Esq., at 7 p.m.

Tues.—*Inst. Civil Engineers*, Discussion upon the papers by Mr. Bramlees and Captain Galton, "On Railway Accidents," at 8 p.m.
Royal Inst., "On the Physiology of the Senses," by John Marshall, Esq., at 3 p.m.
Zoological Soc., at 9 p.m.

Wed.—*Society of Arts*, "On the Decoration of the International Exhibition," by J. G. Grace, Esq., at 8 p.m.
London Inst., "On the Seven Metals of the Ancients," by F. Field, Esq., at 7 p.m.

Thur.—*Royal Inst.*, "On Heat," by Professor Tyndall, at 3 p.m.
Antiquaries, at 8.30 p.m.
Soc. for the Encouragement of the Fine Arts, Conduit-street, "On the Street Architecture of London," by James Edmeston, Esq., at 8 p.m.
Royal Soc., at 8.30 p.m.
Civil and Mechanical Engineers, "On Single and Continuous Straight Girders," by Francis Campin, Esq., C.E., President, at 7.30 p.m.

Fri.—*Royal Inst.*, "On Mauve and Magenta, and the Colouring Matters derived from Coal," by Dr. Hofman, at 8 p.m.
United Service Inst., at 3 p.m.
London Inst., "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.

Sat.—*Royal Inst.*, [illegible] Analyses,"
E. Rosc

MANSFIELD'S AUXILIARY STEERING APPARATUS.

With the permission of Mr. T. B. Mansfield, of Teignmouth, we are enabled this week to give illustrations of plans proposed by him for the working of auxiliary rudders for steering ships. These plans were laid before the Institution of Naval Architects at its recent meeting held at the Society of Arts. Figures 1, 2, 3, and 4, represent a principle of duplicate rudders, and is intended to remedy the existing defect in steering large screw ships, such as the Warrior, the Great Eastern, and their class. It is now pretty generally known that large ships propelled by the screw become, at the very time when their sea-going and steering qualities should be best relied on, more or less unmanageable, inasmuch that in heavy weather, when it is requisite or necessary they should make headway against a gale of wind and heavy sea, these ships become in some instances uncontrollable, and the ship bids defiance to her helm and steersmen. Fortunately for the lives of those on board, and of the great cost and value of some of these ships, they have been in open water with plenty of sea room at the time when the ship has refused to obey the summons of her helm. Had such difficulties taken place on a lee shore, the probability is that both lives and ships would have been sacrificed, and unless there be a remedy for steering such ships, we may ere long learn the sad fate of the loss of one or more of England's best and costly bulwarks.

The plans here represented may with ease and safety be introduced to ships of any size or class, but more particularly to ships of Her Majesty's Navy, as the rudder would be below the main screw shaft, and consequently beyond the reach of shot. The steering gear and steersman may also be on the orlop deck under the water level; the deadwood being maintained entire, consequently will not diminish more than possible the strength of the ship. When the rudder is being acted on for the purpose of bringing the ship about, the lower blade of the screw, on the side the rudder is being applied, will be revolving in an eddy caused by the opening of the rudder, the opposite side doing its propelling work as usual, and thereby assisting the ship around in the direction required of the rudder. The rudders being also fitted on the fore side of the propeller and its aperture, they will have quicker and greater effect in bringing the vessel around, on account of their working in a free and unbroken stream of water—whereas the rudder, as at present fitted, is working in the troubled and disturbed water of the screw. The screw and its aperture being also on the fore side of the rudder is another, and in fact the principal, reason why the screw ship does not feel her helm immediately it is applied, as the current of water required to press on to, and pass over, the lee side of the rudder's surface makes in a large proportion its exit through the aperture, the effect is therefore lost on the rudder, consequently the ship does not answer her helm as quickly as she would otherwise do. Unfortunately, the defect is the more visible at a time when the full steering qualities of the rudder is most required, for the greater the violence of sea or wind against the ship's bows, so in proportion is the leverage required aft; and at such times the accumulated water pent up on the lee side by the action of the

Fig. 9.

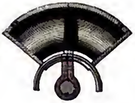
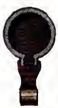


Fig. 10.



MANSFIELD'S AUXILIARY STEERING APPARATUS.

Fig. 1.

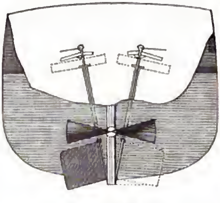


Fig. 2.

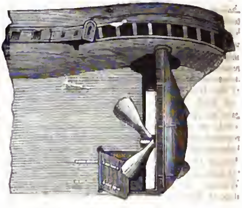


Fig. 3.

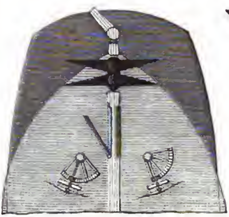


Fig. 4.

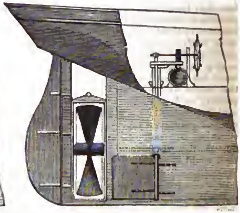
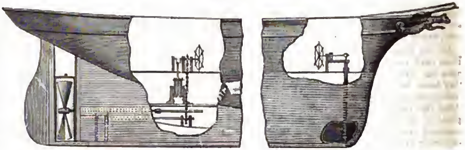


Fig. 5.



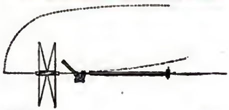
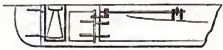


Fig. 6.

Fig. 7.



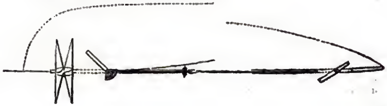


Fig. 8.

is a noble specimen of naval architecture. The nation may be proud of her as a ship of war, unsurpassed in her vast proportions and sea-going qualities; and a monument of science and skill in the manufacture of iron and machinery, but as a fighting ship she is a failure, and in shallow waters, where harbours have to be protected, she is useless. With 100 feet of her length at the bow and stern unprotected, she would soon be disabled by a perfectly iron-clad ship of smaller size, and her great draught renders her fit only for the open seas. In the debate on Monday Sir John Hay, the chairman of the Iron Plate Committee, alluding to the best mode of constructing iron-plated ships, gave his opinion that a combination of iron and wood, or some other flexible material was required, and it is stated, in a report of the duel between the two iron-clad ships, that the cause of damage to the Merrimac was the wood under the armour plates. Now this is the case of the Warrior. The target trial on a section of that ship, at Shoeburyness, proved beyond a doubt that the teak backing would ensure her speedy destruction under the fire of an enemy at close quarters, by causing the plates to be shot away from their fastenings. I pointed out that the punishment inflicted on the target was trifling compared to what the ship would undergo in actual warfare, and yet the effect was most destructive. The Admiralty people contend that no ship in action would be exposed to such a heavy fire. But the late conflict teaches us that battles will be fought between iron-sides precisely as I predicted—muzzle to muzzle—until the armour of one is penetrated, when the damaged combatant must sheer off if she can, otherwise her destruction by missiles fired through the aperture is inevitable. What, then, would be the fate of the Warrior when two or three broadsides would certainly knock some of the plates off her sides.

The Warrior and her sisters, built at an enormous expense as line of battle ships, are not the class for which is the most urgent demand. Half the money spent upon them would in the time they have been building have produced a score of serviceable floating batteries, which, at least, would have made us safe at home.

Let us hope the recent contest in James' River will rouse the Admiralty to action and open the eyes of Government to the course they have to follow. The first and foremost consideration is the coast and harbour defences. After the practical lesson afforded by the exploits of the Merrimac, which in a few hours scattered destruction in her track, sinking or capturing every ship she attacked, and damaging heavily-armed forts, without receiving the slightest injury herself, it would be folly to go on spending millions on such vast fortifications as those which are being constructed at Portsmouth and Chatham. The nation must raise its voice to put a stop to an extravagant and useless expenditure, and demand that the money voted for these works be applied to the construction of floating batteries. Let the Admiralty also be required to suspend the completion of some of the iron giants, and apply a part of the large sums set down in the estimates for armour-plated ships to a more useful class of vessels, which will cost infinitely less, be more promptly afloat, and do far better service to the country.

At this crisis—for it is a crisis, and a most important one—the first duty of the Admiralty is, to determine which is the best, the readiest, and the cheapest mode of constructing rapidly a number of invulnerable ships. Can a ship be made invulnerable? I believe it can; but to ascertain and settle that fact beyond a doubt, or at all events to discover the system which is the nearest approach to invulnerability, the course marked out for the Admiralty is plain enough. They have obtained in the estimates a vote of £40,000 for experiments. Looking at the vast importance of the subject, this is a moderate sum. The House of Commons, if the question be fairly put, would vote double or treble that sum for so eminently national an object. What can be of greater interest than to decide the best mode of averting a great danger? It must be far better to expend some thousands in careful trials of different systems than to engulph millions in half a dozen gigantic vessels, which, after all, are, like the Warrior, merely tentative naval structures, which every day's experience shows will have to be modified.

There has been a great parade in newspapers and in the Houses of Parliament of reports of experiments at Shoeburyness and Portsmouth, but has any good resulted from them? Is there any one point relating to the construction of armour-plated ships settled by these experiments to the satisfaction of any body. If we are to be guided by the discussions raised at scientific meetings, and the contradictory opinions published in the newspapers, the Admiralty experiments have been a waste of money. The labours of the Special Committee on Iron are of a different character—they have been directed to scientific researches into the properties and qualities of iron, and the size and form of plates, and their report, which will soon be published, will no doubt make known many important facts. But if rumour may be relied upon, the committee has had but little opportunity of making trials of armour plating, in consequence of the small amount of money placed at its disposal. The Admiralty, however, has been lavish in that respect. ordering target trials at the public expense without discrimination, and it has been by no means fortunate in the selections it has made, for I believe not one successful target trial has been made by the Admiralty.

There seems to be somewhere a spirit of obstructiveness which keeps aloof from the chance of trial any plan but those of a favoured few. The cause, perhaps, is professional exclusiveness. The department of the controller of the navy is eminently conservative, and, in technical matters controls even the Lords, who habitually defer to the assumed scientific knowledge and practical experience of the officers of that department.

The Iron Plate Committee seem to be in an anomalous position. They have the privilege of examining and reporting, but the Admiralty does not hold itself bound by their reports; so that it is difficult to understand in a practical sense what good the committee can do. The composition and powers of the committee want revision. There is no naval architect of authority among them, and they are a dependancy on two departments—the Admiralty and the War Office—and are not invested with any power of action to carry out their own views, which, however, is requisite to render their services useful. When appointed, it was considered that their principal function was to select for trial plans of armour plating referred to them by the Admiralty or War Office. But of what use is that arrangement if their recommendations are not carried out, and if the authorities order plans to be tried which either are not recommended by the Committee, or not referred to them at all. Last summer it was arranged that four eminent shipbuilders should act as consulting members of the Iron Committee—an excellent arrangement, as among the six scientific and able gentlemen who compose the committee there was no shipbuilder. The only result was that each of the four gentlemen proposed a plan of his own, and obtained an order for a trial target, or for a ship, not however from the Committee, but from the Admiralty. No doubt there were good reasons for the choice of those plans for trial, the secretary to the Admiralty having informed the House that the inventors were "great authorities." Perhaps it would have been better if they had not been consulting members of the committee, sitting in judgment on their own plans, or if they had directed their attention to other plans besides their own. However that may be, it does not appear that after the orders referred to were given by the Admiralty, the shipbuilding counsellors contributed their valuable aid to the Iron Plate Committee.

The conflict between the Merrimac and the Monitor leaves no doubt that practically ships can be made invulnerable. Much has been said about enormous projectiles of 300 to 1,000 pounds, of which no armour-plated ship can be made to withstand the shock; but the guns have yet to be made, and the cost of each shot, as well as the means of loading, have to be counted and invented. If even the construction and general use of guns for these monster missiles are carried into effect, which is more than doubtful, many years must elapse before ships will be exposed to their fire. In the meantime, they will be constructed as nearly invulnerable as possible, and that is all we have now to look at. The Admiralty will in the end be obliged to adopt the best system of armour plating. There is no escape from this obligation. Sooner or later, and at no distant period, this necessity will be forced upon the Government by public opinion, however reluctant the Admiralty may be to listen to reason. Whilst other Governments are active and energetic, and spare no expense in ascertaining the best mode of casing ships in iron mail, England cannot stand still. Spain has a maritime commission in London and in Paris, collecting information, observing, and reporting. From America we hear that not only the United States and Confederate Governments are making prodigious efforts without regard to expense, to ascertain and carry out the best system of constructing these indispensable national defences, but the citizens of New York and Boston, and other coast towns, are adopting measures to execute the same design for local protection. France is earnestly but quietly at work, adding vessel to vessel, and not only of the Gloire class, which we sometimes hear about, but also invulnerable gun boats, of which no less than fifty are in a forward state, and each of which will be equal to a Monitor. In this metropolis, France is represented by qualified agents, under the orders of its Embassy, who pry and peer into all the new inventions they hear of.

Amidst this energy and activity the Admiralty is following its old traditions—exclusiveness, mystery, hauteur. Under ordinary circumstances, John Bull good-humouredly yields to the circumlocution of a department under the management of a class of men whose patriotism can be relied upon, but here is a case which admits of no delay or compromise. The best mode of applying a new system has to be determined, and that can only be done by actual trial. The nation has voted the money, let it be promptly applied. The cause is urgent; better to spend a few thousands now in useful experiments, and quickly settle the question, than go on spending tens of thousands on plans which are known to be defective.

Large plates, through bolts, tongueing and grooving, and wood backing, all of which were adopted by the Admiralty without previous trial, are proved to be defects in the present method of armour plating, and yet, with one exception, they are retained as parts of the great ships now under construction. The Admiralty adopt the singular course of trying a few experiments at a time, and at distant intervals, instead of trying a great many in the shortest possible time. The latter is clearly the proper mode. The former is a waste of time, and its adoption is the cause of the ignorance or doubt in which the Government is kept on this subject. Common sense would dictate the expediency, nay, the absolute necessity of determining every point of a new system, before carrying it out on a large scale. A liberal expenditure in trials would be economy in the long run.

As I have before said, a sound discretion must be used in the selection of plans for trial. There is a special committee to advise and assist in the choice of plans. Let confidence be placed in that committee; let its powers, if necessary, be extended; and trials be made liberally of the plans it recommends. That is the way to get at the truth. Above all, be fair and just, and allow no private or political influences to have any weight in this great national matter, on which the existence of England as a maritime power depends.

A Civilian.

THE WESTERN ANNEXE AT THE EXHIBITION.

We are within a month of the opening of the Exhibition, and the Western Annexe, destined for the reception of machinery in motion, looks as if it would take thrice that time to be ready for operations. There is unquestionably much material in the building, but it is chiefly the *disjecta membra* of machines which are to exhibit hereafter, and are at present less instructive than suggestive of what will be some three or four weeks hence. Of course, an *expert* can tell from disjointed parts the place they will occupy in the machine, and to what office they will be put; but to an ordinary visitor the separate parts of machines which are to exhibit hereafter the results of human cunning and elaborate workmanship, tell very little.

There is scarcely a single machine in working order, if we except a beautiful locomotive from Leeds, and two steam cranes, which are doing the work of unloading and removing to their destination in the building, enormous masses and packages of machinery. But progress is visible from hour to hour. The tool is never idle in the hands of those who are intrusted with the erection of the various machines, and where no portion of a machine is yet visible, we can infer that the advent is not far distant, judging by preparations in the form of immense foundations to receive heavy weights of metal.

The English department is the farthest advanced, and from the mere framework and portions lying about, we can readily infer that it will be unrivalled in magnitude and variety. With the exception of the 400 horse-power screw propeller, manufactured by the New Mediterranean Forge and Shipbuilding Company, which will be a conspicuous object—a hydraulic turn-table from the hot-blast furnaces of Meubeuge (Nord), and a six shuttle ribbon loom from Basle, in Switzerland—a most ingenius apparatus—the foreign exhibitors have not yet made much progress. There is nothing visible in the space allotted to Italy, Belgium, Austria, and the Zollverein but heaps of unpacked cases. Of course, it is impossible to speak of the invisible, but certainly we need not be afraid of being surpassed, or even approached in variety and utility of our machinery. The French double-cylinder marine engine is certainly of most beautiful workmanship, and such as any engineer might be well proud of, but we shall have an opportunity shortly of comparing it with similar constructions of our own, especially that by Todd and McGregor, of Glasgow, which is 650-horse power. There is in the French court a large double crank, weighing seven tons, and forged at once, brightly turned, and admired by English workmen for its fine proportions; but then as a set off, we have the crank made at the Mersey Steel Works, weighing 25 tons. In the English department, amongst the machines partly erected or almost completed, one is struck with the ponderous sugar mills exhibited by Merrilees and Tait, and McOnie and Co., of Glasgow. The rollers in one of those of the former, are the largest ever constructed, being seven feet in length, and three feet in diameter; the rotatory flanges make 1,500 revolutions per minute, separate the sugar from the molasses, and accomplishes in an hour an operation which formerly occupied a fortnight. Vying in weight and bulk are the enormous cylinders of a paper-making machine, by Donkin, now being placed in position. This machine will not be put in motion, as it would require nearly half the length of the annexe to exhibit the process of paper making. In kindred proximity is one of Main's useful tumbler printing machines, which will be set to work for practical purposes during the exhibition. Not far off, and nearly completed, stand the sawing and planing machines of Messrs. Powis & James, and beside them a powerful machine, by Mr. Young, of Ayr, which cuts 3,000 feet of battens a day, the saw making 250 strokes per minute. In this cluster are also Mr. Worssam's sawing, planing, and morticing machines, the latter exceedingly complex to the eye, but which is calculated to do all that is required from it with rapidity and precision. A less pretentious in mechanism, but equally useful, is Clayton's brick-making machine, by means of which 50 bricks per minute, or 30,000 in a day of ten hours, can be turned out. It crushes, feeds, and makes at once. The machine is furnished with rotatory dies for solid brick-making. The same engineers have also an ingenious machine for making peats. As in 1851 there are a great number of machines for spinning, weaving and printing cotton, the principal exhibitors being Messrs. Platt and Co., of Oldham, Messrs. Hodgson, of Bradford, and Messrs. Smith Bros., of Heywood. All these machines will be put in motion, and will form one of the most attractive features of the Exhibition. We see that in the neighbourhood of these, space is reserved for an American weaving machine. Next week, however, we hope to be able to speak more in detail of various machines and accessions.

While in presence of ponderous masses of metal, one cannot fail to be struck with the slender and frail appearance of the building which contains them. Already several of the wooden uprights deviate considerably from the perpendicular, and it is thought by practical men, that should Nasmyth's steam hammer arrive and be put in motion, it may cause vibrations in the structure of a serious nature. The steam for the machinery in motion, which is under the direction of Mr. Clark, will be supplied by 6 boilers 30 feet long, and 6½ feet diameter. The steam pipes are laid down in two trenches about 5 feet in width, by about 3 feet in depth, and are perforated at intervals for the insertion of supply pipes for the different engines.

RAILWAY EMBANKMENT ACROSS DOVER STRAITS TO FRANCE.

We have recently submitted to the public several schemes for uniting England to France by railway, and we now beg to call attention to a plan developed in a letter to the *Whitehaven Herald*, and signed "Neptune."

"Happening," says Neptune, "to attend the lecture recently delivered to a Whitehaven audience, under the auspices of the Mechanics' Institution, by Mr. Henry Cook, the Secretary to the Whitehaven Junction and Whitehaven and Furness Junction Railways, on Mr. Chambers's project for carrying an iron tube across the bed of the English Channel to join the French and English coasts by a railway, and having taken some interest in the question since of a railway communication between England and France, the feasibility and merits of Mr. Chambers's tube scheme have been occasionally weighed in my mind. The scheme, no doubt, may have many advocates besides Mr. Cook; but my opinion of the whole affair is, that while the conception itself, and the management of the details connected with the plan, show very considerable ingenuity on the part of the projector, yet there is something about it so plaything-like that I wonder any really practical mind does indulge the hope of seeing it carried out. The momentous results contemplated, affecting, as they would, the interests of civilization and commerce of the Old World, should any scheme of a permanent character be successfully achieved for uniting the railway system of this country to that of the continent, must be realized by all who have given the matter any consideration; and deeply impressed as I am with its immense importance, as bearing on the future destinies of Europe and Asia, I have thought whether a more likely project could be conceived than any of the plans hitherto laid before the public.

An embankment carried across the channel, formed of rocky and rubble materials, obtainable in plentiful abundance on the coasts of England and France, adjacent to the site for the work, appears to me the soundest scheme; and as the surplus labour available in the Western States of Europe and of all Great Britain would be forthcoming for such an undertaking, the cost of constructing it, though a mighty work, would not be so serious a matter as may at first appear. The sectional form of the embankment should not be exactly that of ordinary railway embankments. It would have a level flat surface for the various lines of rails of different companies, which would be about 30 feet above the level of the sea at high water, and having a mound of rock on each side (their use being obvious) 20 feet high and 40 to 60 feet at the base, and angular, or parabolic shaped. The level flat surface for the railways would be a mile across from inside of mound to inside. The sides of the embankment would slope down into the sea at an angle of 45 degrees at level of high water, and, spreading out as they approach the bottom, would afford ample space for the raging billows rolling along the channel during a winter storm to expend their fury. There would have to be a lofty lighthouse, either in the centre of the embankment, showing a revolving brilliant light, or a lighthouse on each side, one showing a red and the other a green light, stationary. The site for the embankment would be chosen as nearly opposite to the boldest points of the rocky acclivities of the two coasts as practicable, with the object of carrying a cutting through for the lines of rail, which operation would be the commencement of the undertaking, as it would afford a large amount of rocky material with which to start the embankment. I am bold to say that if the French and English Governments once granted their approval and consent to the scheme, and would further proffer the assistance of the most skilful engineers and sappers and miners, together with a troop of the most reliable and energetic portion of their unoccupied armies, in conjunction with a small army of labourers collected out of the various states and provinces of Western Europe and Great Britain, and further, if the two Governments would engage to provide the requisite appliances and an unlimited supply of powder out of the stocks lying in their various arsenals, I am prepared to say this important undertaking would be carried out to a successful issue at comparatively a very moderate cost in the short space of six or seven years from its commencement. The arrangements, of course, should be all made under the guidance and management of eminent civil engineers of this country and France. After carrying the cuttings through say two miles to three miles wide, until they find a proper level inland for joining the various lines of rail on the continent, and within certain limits, and calculating how far the operation of quarrying and exploding the rock would be required to obtain a sufficiency of material to complete the work—the solid contents of the rock required to make the whole embankment being known—the measurements would then be easily taken of the adjacent cliffs to find out the extent it would be required to prosecute the quarry operations to furnish the material. The next operation would be quarrying laterally to the direction of the embankment upon the edge and parallel with the two sea coasts, and until the embankment was finished. It is a very simple calculation to ascertain to what limit these quarrying operations should be extended, knowing the solid contents of the material required to complete the undertaking. The iron rails now in use on the lines of this country and the continent are not of sufficient strength and substance to convey the weights that they would be required to bear; and it would be, therefore, necessary to have manufactured rails of say 50 to 75 per cent. larger sectional area. The tilt waggons and locomotive engines would have to be of a ponderous description in size, strength, and power to convey the immense weights they would be required to carry over the embankment. Powerful cranes would also be required to lift the immense masses of rock that would have to be conveyed along the line to the sea coast and along the embankment to be deposited on the bed of the channel.

As far as I have gone, the first thought that will strike the reader is the fact that the passage of the channel for shipping is completely blocked up. To obviate the inconvenience thus occasioned to the free navigation of shipping through Dover Straits, I have next to propose that we make what I shall for my present purpose designate double harbours of refuge on both sides of the channel, the sites of which should be at the extremities of the embankment somewhat inland. They would have to be upon a very large scale to afford the necessary accommodation for such shipping as may be necessitated to wait for an opportunity to proceed to sea. The harbours would consist of a basin on each side of the embankment, for admitting the vessels arriving from the Atlantic or the North Sea side of the channel, until they gain admittance into the floating dock. The latter would be made inside of the basins, and at each side of the embankment, say about one mile apart, or in a line with the mounds, and being joined by a lock of sufficient width to allow shipping to pass of the largest tonnage. The use and object of these harbours I will now proceed to explain. We will suppose an East Indiaman outward bound from London. She takes a powerful tug and tows away down the Thames, and through the downs, and in the direction of the railway embankment. If the wind is blowing from the west she steers her course towards the railway harbour on the English side of the channel. If it blows from the east, she takes her way across to the French side, the difference in the distance not being so much. She would probably arrive, judging of the distance and the rate of speed she would make her way astern of the tug, about 12 hours from the time she left London. As it is of course high water she is towed through the basin, and, the gates being open, into the floating dock, passes through the lock or canal, and into the floating dock on the other side, and, towing out of it, without stopping, through the south basin, and away, to sea. She would then cast off the tug, set canvas, and prosecute her voyage down channel without any interruption upon her way to the Atlantic. To further develop the idea, a Grand Trunk Railway would be the next operation, carrying it across Europe, through Belgium and the southern districts of Germany, making a boring through the Alps range of mountains, and crossing Turkey in Europe, passing the Bosphorus, through Turkey in Asia, across Persia, Cabool, and, going near the southern base of the Himalaya mountains, continued on to China as far as Pekin. The amount of wealth required to work out this vast scheme no doubt may be a great obstacle to its present achievement; but the day is not so very far distant when it will be a work of sheer necessity from the force of circumstances now arising

As far as I have gone, I trust I have sufficiently and clearly explained the outline of my scheme to make it easily understood; and feeling a strong conviction that it will attract the attention of capitalists and eminent engineers, I dismiss it from my mind, until it shall have received their examination, and all its points for or against have been freely discussed.

CAPTAIN BOLTON'S TELEGRAPHIC NIGHT SIGNALS.

The experiments, says the *Times*, which have been for some time in progress at Chatham, by direction of the Duke of Cambridge, for testing the newly-invented lime-light telegraphic night signals, the invention of Capt. Bolton, 12th Regiment, by means of which messages of every description can be transmitted with the greatest rapidity and correctness a distance of 50 miles, have just been brought to a close. The final official trial took place in the presence of Major-General Eyre, commanding the forces in the district, and about 50 officers of the garrison. The object of the final experiments was to enable the military authorities to ascertain the advantages of the invention in transmitting messages to the different portions of an army when in active operations in the field, in order that a special report might be made on the subject. With the view of putting the invention to a test similar to that which would be required in a campaign, detachments of troops were despatched from Chatham to distant parts of the surrounding districts, to each of which signals were to be forwarded. One party of signalists occupied an eminence, about mid-distance between Chatham and Gravesend; a second took up their position on the highest point of the range of hills at Aylesford, a short distance from Maidstone. Other parties were stationed at Sheerness, Upchurch, and other stations. The whole formed a circle the diameter of which was about 15 miles with Chatham as the centre. Each party was furnished with one of the lanterns, together with the small, portable apparatus, also the invention of Capt. Bolton, for generating the oxygen and hydrogen gases, by which the lime light is produced. The plan of operations supposed an attacking force to be concentrated near the banks of the Medway, between Chatham and Rainham, the strength of position of which being known it would be desirable to transmit intelligence of the circumstance to distant places, in order that the necessary reinforcements might be immediately despatched to the scene of action. By direction of General Eyre, various descriptions of messages were despatched by Capt. Bolton, and the party under his orders to the various stations, all of which were correctly recorded and instantaneously replied to. Unfortunately, the weather was thick and hazy, but this did not prevent the lime light signals from being distinctly visible, the brilliant flashes penetrating the thick atmosphere even at the distance of 15 miles, while most of the surrounding objects were hid in the mist. The men employed in working the signals had been selected from the troops of the garrison who have been placed under the instruction of Captain Bolton, and they were found to despatch and record the various messages with the greatest facility. After a trial, which occupied about two hours, Captain Bolton exhibited the use to which the lime light could be put in lighting up the works of a garrison in order to ascertain the strength of position of an attacking party at night, and also to enable storming parties to attack a fortified position under cover of the darkness. By a modification of his lanterns Captain Bolton was enabled to produce a light which for a distance of 300 yards was equal to strong moonlight, enabling every object within that limit to be clearly discernible. The final trial was pronounced to be exceedingly satisfactory, and a highly favourable report of the invention will, it is understood, be transmitted to his Royal Highness the Commander-in-Chief.

BLANKLEYS' INVENTIONS.

BLANKLEYS' REVERSIBLE BELT.

Messrs. W. and F. Blankley, of 10 Silver-street, City, have lately invented and registered a belt, which answers the purpose of two belts by merely shifting the solitaires, which are so arranged as to be a great improvement in the appearance of the article, and has this advantage over ordinary belts, namely, the clasp can be detached (at pleasure) from the belt and any other placed in its stead.

BLANKLEYS' SELF-ADJUSTING LADIES DRESS-HOLDERS.

This useful article has just been brought out by the above firm. It is in the form of a ladies' belt, and the dress holders which are attached to it, are laid in the folds of the ladies dress, and all that is necessary, is to draw out the buttons placed near the clasp, and immediately the dress is gracefully raised all round to any height required.

BLANKLEYS ROYAL ARTILLERY BELT.

This is a new registered design in clasps, and appears to surpass all that have preceded it. Its appearance being well proportioned, and the fastening formed by the body of the cannon passing through the wheel, which holds it so securely that it is impossible to be undone without the withdrawal of the cannon.

BRONZE GUNS.

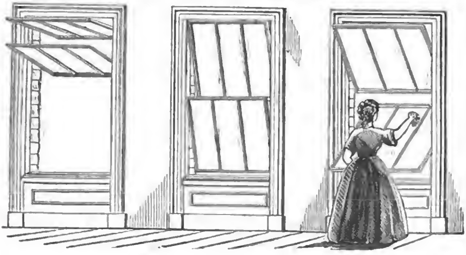
At the Rogers' locomotive works, experiments are being made on a peculiar mode of casting bronze guns; and we are glad to find them likely to prove successful. A Mr. Morris, from Pittsburgh, who has had large experience in the casting of the celebrated iron columbiads for heavy fortification guns, is superintending the experiments. He is now turning his attention to applying the principle to the casting of bronze guns. These have hitherto been cast solid and the entire amount of metal of whatever calibre bored out afterwards, thereby not only making much waste, but taking a vast amount of labour; and what is worse, producing a gun, which on account of its softness, is very soon destroyed, more especially, if rifled and using a winged or conical projectile.

Those guns cast for Mr. Morris, are cast hollow, with what is known as the "circulating water core." This consists of a double tube, one within the other, the outer one being coated with some kind of loam and sand in the usual manner of making cores; and the inner one being smaller leaves a space between its exterior surface and the interior surface of the outer one. The inner tube does not quite reach to the bottom of the other, but leaves a space for a return passage. Water is conveyed during the casting and cooling of the gun, into the mouth of the outer tube which forces its way toward the bottom, and returning rises and escapes in a hot condition. Some twenty five feet head is used for this injection water.

The mould is also different from the ordinary loam or the dry sand mould. It is composed of a mixture of kaolin, clay, quartz, and mica, the whole, when in combination, forming a perfectly fire-proof, and, at the same time, a very porous mould, leaving a free egress for the pent-up gases. This is, of itself a desideratum in good casting.

The result of all this is a homogeneousness in the metal, and therefore a greater capacity to bear strain—a harder surface for the abrading action of the cone shot, and a greater strength in proportion to its weight.—*Paterson (N. J.) Guardi*

IMPROVED WINDOW ARRANGEMENT.



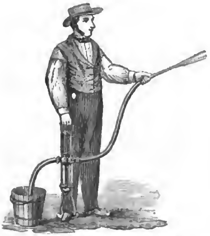
A **company** has lately beeen formed for the purpose of bringing into active use an arrangement for opening and closing windows of dwelling houses, and which enables them to be cleaned without the necessity of persons going outside. The above engraving illustrates the various positions the sashes can be placed, and turned so as to allow of the outside of the window being cleaned from the interior of the room. It will be seen that both sashes of one window are thrown up to the top of the opening, thus enabling furniture or other bulky articles to pass in or out without removing the sashes as usual. A perfect system of ventilation may be effected, by reason of opening one sash, say the lower one, the upper one being open at the same time, thus dmitting fresh air at the bottom, and permitting the vitiated air to escape at the top. The arrangement can be adapted with ease to all windows on the old principle, at a very moderate cost, varying according to the dimensions of the windows; an outlay soon repaid, when the expense attendant on the employment of glaziers and others in cleaning is considered. We consider the invention a very useful one, and likely to be extensively applied. Further information may be obtained at the offices, 9 Adam Street, Adelphi.

CARBON IN IRON.

Weyl has given an ingenious and simple method of determining the quantity of carbon in cast-iron and steel without the previous difficult and laborious pulverization of the metal. The method consists in making the iron to be analyzed the positive electrode in dilute chlorhydric acid, when the iron dissolves, leaving the carbon, and without evolution of gas. To prevent the iron from becoming passive, which would produce an evolution of chlorine, it is only necessary to regulate the strength of the current by adjusting the distance of the electrodes from each other, so that only protochloride of iron is formed; the formation of the sesquichloride is indicated by the yellow colour of the solution. A single Bunsen's element is sufficient, and the iron dissolves as protocloride, leaving the carbon as a pseudomorph. The iron to be dissolved may be held in a forceps provided with platinum points, but so that the points of contact between the platinum and the iron cannot be moistened by the liquid. The separated carbon is to be collected upon an asbestos filter, dried in a current of air, and burned with oxyde of copper and oxygen in the usual manner. The weight of the iron dissolved is easily found, by weighing the portion which remains between the platinum points and the surface of the acid, after the complete solution of the immersed portion. A number of analyses conducted according to this method gave results which closely corresponded, and which were usually a little higher than those obtained by the ordinary methods. With respect to the time required, the author remarks that a piece of cast-iron weighing about eight grammes, is dissolved in twenty-four hours.—*Pogg. Ann.* cxiv. 507.—*Silliman's Journal.*

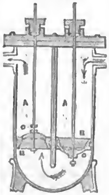
THE PATENT HYDROPULT, OR PORTABLE FIRE AND GARDEN ENGINE.

Fig. 1.

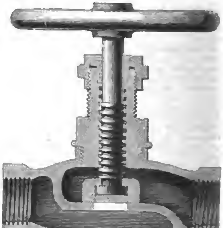


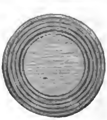
This ingenious, but simple contrivance, though so insignificant and valueless in appearance, is, notwithstanding, one of the most powerful, unique, and useful illustrations of the practical application of scientific principles to common things. Though scarcely two feet in length, and weighing but *eight pounds*, it is superior in its use to the ordinary garden engine, or that revered piece of antiquity, the *parish* engine, and its attendant magnate, the beadle, in all the splendour of his three-cornered hat, and gold-bedizened coat. It can be entrusted to the most inexperienced youth, who can use it with ease, and bring it into action at once, without the possibility of disappointment or failure. The great feature in this invention is its simplicity, which will be evident from the engravings shown at the head of this article. Fig. 1 is an illustration of the way in which it is used for gardening and other purposes. Fig. 2 being a sectional view of the instrument, showing the principles of its action. It consists of two parallel metal cylinders (*A A*), and boxes (*B B*), fitted with valves (*C C*), so arranged that whether you push the piston down or pull it upwards it expels the water through the india-rubber pipe at the rate of *eight gallons per minute* (the velocity being always proportionate to the force applied by the hand). The arrows show the direction of the water. For extinguishing a fire at its commencement, protecting a roof from taking fire, sprinkling plants, watering gardens, cleansing trees from insects, wetting sidewalks, washing windows and carriages, draining cellars, boats, and indeed, performing any service to which an hydrant or force-pump is applicable, it is invaluable and trustworthy. We understand that the manufacturers, Messrs. Griffiths and Browsett, of Birmingham, are extending the power and range of the instrument to the capacity of 25 and 30 gallons per minute, a circumstance which cannot fail to commend it to the notice of the proprietors of warehouses and other buildings, public and private, in the metropolis and provinces. The Hydropult possesses the advantages of economy, utility, and applicability to a variety of purposes. Further particulars may be obtained from Mr. Charles P. Button, at 27, Leadenhall Street, E.C.

Fig. 2.



HALE'S GROOVED PLUG FOR TAPS.





This invention, just patented by Mr. T. F. Hale, Brass-founder, Bristol, consists of a plug, with the bottom corrugated or formed with annular grooves, as clearly represented in the above engravings (the lower view exhibits the grooves), and of a flat surface or seat surrounding the aperture to be opened or closed. The plug is forced down upon the seat to close it. Instead of the face of the plug being grooved, it may be made flat, and the seat grooved or corrugated.

ROYAL NATIONAL LIFE-BOAT INSTITUTION.

The Annual General Meeting of the friends and supporters of this Institution was held on Tuesday, the 18th ult. at the London Tavern; The Right Hon. the **Lord Mayor** of London in the Chair. After some appropriate remarks, his Lordship called on the Secretary, to read the annual report, which stated that, during the past

TO CORRESPONDENTS.

Received.—O. P., W. A. G., E. F., J. A. D., C. K., J. P., Capt. N., J. B. M., J. H. J., W. R., Artillerist, R. P. E., J. P., Prof. C. C., "A Sufferer" (another letter, taking the same view, before "A Sufferer's" came), F. B., W. H., G. C., R. B., F. A. F., Civil and Mechanical Engineers' Society, T. H. R., R. S., J. A., J. H. J., G. C., J. N., T. B. M., L. B. and Co., W. G.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

ON THE CONSTRUCTION OF AN ATLANTIC TELEGRAPH CABLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The slow growth of a second Atlantic Cable gradually evolves itself. A vague notion of what an efficient cable should be seems to have taken possession of the public mind, and when the point has been satisfactorily comprehended, the thing will have become a substantial reality. In the meantime, we must be prepared for a variety of styles in the construction of the cable, and these, from whomsoever they may emanate, will be closely and severely criticised, because this is pre-eminently a national matter. In ordinary affairs the proceedings of a company have little or no interest for any one save the shareholders; but this is an exceptional case, and the Atlantic Telegraph Company can be scarcely said to have the right of pleasing themselves in their choice of a cable—there is a public to be deferred to, and consulted, through the eminent scientific men who are entrusted with the public confidence; the nation not only feels its interest at stake, but its well-being, and the well-being of the world at large, to say nothing of the earnest desire to guard against a repetition of gigantic failures.

It was anticipated, therefore, that Messrs. Glass, Elliot, and Co., would, in submitting a specimen of a second cable, have produced such an one as should have indicated an emulous spirit, and a determination to retrieve a past disaster; and in justice we must consider them as having been actuated by such motives; and yet the description, given in your last, of the specimen submitted to the Atlantic Telegraph Company by the firm above-mentioned is far from being such as was anticipated by many persons who are deeply interested in the success of an Atlantic cable. It is considered as falling far short of what was justly expected under the circumstances.

In making the following remarks, therefore, I do but echo the opinions of, I should say, the majority of thinking men, men who are capable of forming an independent opinion, unbiassed and impartial.

Of course, no other description of core than gutta-percha and its compounds was to be expected; it is, therefore, superogatory to protest against that part of it, notwithstanding, it is more than probable that that was the principal cause of the failure of the old cable; and yet to be on the safe side in this respect, pure caoutchouc should certainly be chosen as the insulator.

It is doubtless from a mistrust of the efficiency of gutta percha as an insulator that has led to the substitution of additional layers of that material, instead of the serving of tarred yarn, which has been heretofore used for overlapping the core, and which is eminently protective and durable. Nor do I think that the proposed substitution, although considerably more expensive, will be any improvement.

And then with respect to the outer covering—a matter as essentially necessary to be constructed on right principles as the core itself—we find certain unimportant changes made, which at best are but doubtful improvements, while the great bane of all submarine cables for long lengths of deep seas is retained—I refer to the spiral application of thirteen strands of gutta-percha-coated iron wire. A cable so constructed is necessarily liable to elongation, thereby causing its whole weight to fall upon the core; and although this core may be unusually strong, from the mass of copper in the conductor, and the extreme thickness of the insulation, still such a prodigous weight could not be thrown upon it with impunity, as it must of necessity produce a flaw from overstraining, and so hasten its inevitable destruction.

This consideration includes also another grave objection by no means to be overlooked, viz., the immense weight of the proposed cable. It is my opinion, as expressed in a former letter, that for long lengths, a deep sea cable should be used of as light a specific gravity as possible compatible with strength, effectual protection of the core, and lasting durability; and this opinion is not founded on mere theory: it is borne out by facts, and supported by the testimony of eminent practical electricians, and is abundantly illustrated by the past history of submarine telegraphy. But here is a cable proposed as the connecting link between the two hemispheres, which will weigh little short of four tons per nautical mile, a matter of itself quite sufficient to ensure a miscarriage in the paying-out at sea; and then it is totally unnecessary, seeing that cables, equally strong, protective, and durable, are to be had at less than half the weight with the double advantage, too, of being a real protector of the core, since it is so constructed as to show no elongation that can possibly affect it. I should be glad to be informed upon what grounds these heavy, cumbrous cables are preferred; and should be most happy to have an opportunity of weighing the arguments which may be urged in their favour. To me it appears a most mistaken notion that, in order to secure a strong and durable cable, it must of necessity be so tremendously heavy.

At all events, the objections above urged are at least entitled to some consideration. I deem them most weighty as applied to an enterprise of which the past history of the world has no parallel, and which, from the almost insurmountable difficulties there are to contend with, renders it absolutely necessary that everything should be avoided, whether in the core or the outer sheathing, that may have the remotest tendency to render all the labour, anxiety, and expense of another cable abortive.

I would respectfully ask, in conclusion, why it is that the Atlantic Telegraph Company so persistently eschew the recommendation of the committee appointed by Government to inquire into the construction of submarine cables?

Is it not a fact, that after a patient examination of many witnesses pro and con., with their multitudes of abstruse experimental tables, that the said committee recommend *caoutchouc insulation*, and cables of *a light specific gravity*, for deep seas? And was not the sad and deplorable fact of the failure of the first Atlantic cable the principal cause of that committee being called into existence? PHILO.

29th March, 1862.

◆

THE BESSEMER PROCESS.

SIR,—As this process seems to attract at present a great deal of notice, it may interest parties wishing to adopt it to learn how the question of patent rights really stands as regards the pneumatic process, and I have, therefore, briefly reviewed these matters, and now proceed to give my deductions therefrom.

In his patent No. 2321, dated 17th October, 1855, Bessemer claims the forcing of currents of air, or of steam, or of air and steam into and among the particles of molton crude iron, or of re-melted pig or refined iron, until the metal so treated is thereby rendered malleable, and has acquired other properties common to cast steel, and still retaining the fluid state of such metal. The patentee here claims to render crude iron malleable by forcing air or steam, or air and steam jointly amongst the molten particles of the crude iron. Now it can be clearly shown that one of these methods, viz., that in which steam alone is employed wholly fails, for the effect of the application of steam is to consolidate melted crude iron long before this crude iron has been so far decarbonised as to become malleable, and it is neither rendered malleable, nor is it brought into such a state as to possess other properties common to cast steel, neither does it still retain the fluid state. Therefore, one of the patentee's methods being impracticable, his patent is void.

In the same patent Bessemer states that if during his process "too much carbon has been driven off, an addition may be made of some melted iron from the cupola or finery." Now it can be shown that the addition of melted iron from the finery or cupola to the decarbonised metal wholly destroys its malleability, so that the ingots or castings made from this mixture crack to pieces when it is attempted to roll or hammer them into bars. When, however, a pure alloy of iron and Manganese, containing also carbon, such as is known in commerce as Spiegel Eisen, is added to the decarbonised metal, then the mixture is rendered perfectly malleable and ductile. Now the patentee has here either, in ignorance claimed the use of ordinary cast iron to re-carbonise his decarbonised metal, taking it for granted that it would answer the purpose intended, without destroying the malleability of the mixture, or he has neglected to specify the fact that only one kind of cast iron, viz., Spiegel Eisen, being an alloy of iron and Manganese, will re-carbonise the metal, and confer upon it ductility under the hammer. On the former supposition the patentee's claim fails, because he has claimed the addition of cast iron in general, whilst, in fact, only one particular variety of cast iron can be successfully used, and which is a special alloy of Manganese and iron; and on the second supposition his claim is void, because he has not specified the one particular and remarkable variety of cast iron which alone can be successfully employed in the patented process to re-carbonise his metal.

In patent No. 2768, dated 7th Dec., 1855, Bessemer claims:—

"The recarbonisation of his decarbonised crude iron, and the preparing it for foundry purposes by forcing into the decarbonised metal carbonaceous gases or carbonaceous matters;" and he states that by the use of solid carbonaceous matters forced beneath the surface of the decarbonised crude iron, the said decarbonised crude iron may be re-carbonised, and a very pure quality of foundry iron may be thus obtained. Now actual experiments show that neither the forcing of carbonaceous gas amongst the particles of melted decarbonised crude iron, nor the forcing of solid carbonaceous matters, such as billets of dry wood underneath the surface of the said decarbonised crude iron does in the least degree re-carbonise the metal, or bring it into the state of foundry iron. The patentee, therefore, has distinctly claimed two methods of re-carbonising his decarbonised metal, both of which fail wholly to effect the object he has in view. Therefore, this patent also is void.

Moreover, the patentee states "that if steam be used alone towards the close of the decarbonising process a great difficulty is experienced in the requisite heat and fluidity of the iron, which is apt to assume a pasty condition." Now, the fact is, that it is impossible to employ steam at all towards the close of the operation for the action of the steam is to consolidate the metal instantaneously, and the practice of the patentee who does not employ steam at all, clearly indicates that it does not answer, though he professes in his patent that its use assists in the removal of sulphur from the iron. Finding out that his claim in the patent of 17th October, 1855, to render crude iron malleable by forcing steam through it, was untenable, and in practice impossible, the patentee endeavours to qualify this fatal error by stating, in his patent of 7th Dec., 1855, that he prefers to use steam only during the earlier part of his process. This afterthought merely confirms the invalidity of both these patents. Also, with strange inconsistency, the patentee, in his sixth claim, in patent of 7th Dec., 1855, actually claims the forcing of steam through melted crude iron until the metal so treated is converted into malleable iron whilst still retaining a fluid state, and which is claiming to practice that which it impossible, so on this ground also the patent is void.

In his patent dated 12th Feb., 1856, Bessemer merely claims what he had already claimed in his untenable patents of 17th Oct. and 7th Dec., 1855, confining, himself, however, to the use of air only in his process, and endeavouring to stamp a novelty upon the claim by stating that he has discovered that the air thus forced into the crude iron produces a vivid combustion, and, therefore, intense heat, so that no fuel but the iron and carbon of the iron itself, is required in order to keep the iron fluid till the operation is completed. That the patentee was previously quite aware of this vivid combustion is palpable from his description of it in his specifications of the 17th Oct. and 7th Dec., 1855, so that it could have been no novelty to him at 12th Feb., 1856.

He also claims to carry his invention out without the use of fuel for re-heating or continuing to heat the crude molten metal, whereas the fact is, that he employs the carbon of the iron, and towards the close of the operation the iron itself as the fuel, which continues to heat the iron, so that at last the iron in its malleable state is heated so as to be in a liquid and molten state, and, by prolonging the process, the whole of the iron may be consumed as fuel, with a constantly increasing development of heat. Crude iron is carbonaceous matter, and, when burnt, it is to all intents and purposes fuel. To have been valid, the patentee's claim should have been for continuing and maintaining the heat requisite to retain steel or malleable iron in a liquid state, with no other fuel than the carbon and iron operated upon and the oxygen of the atmosphere.

Moreover, in his specification of 17th Oct., 1855, Bessemer distinctly states that he does not confine himself to the precise details he has therein given of his invention, but that all he claims is the forcing of air, or of steam, or of both jointly into and among the particles of crude molten iron, until the metal thus treated is rendered malleable, and he does not add that he requires, or that he does not require, fuel for this purpose more or less than that supplied by the combustion of the iron and carbon, so that in effect the claim here is either for using fuel or not using fuel as the operator may think fit, and in [illegible] 12th Feb., 18[illegible]ntee merel these methods, viz., that which employs no other fuel than that of the iron and its carbon. Therefore, if he has been shown the patents of 17th Oct. and 7th Dec., 1855, are void, the patent of 12th Feb., 1856, which is a mere partial repetition of that of 17th Oct., 1856, is necessarily also void, and Bessemer's subsequent patents built upon the same defective foundation are alike invalidated.

Martien's claim also, of 15th Sept., 1855, for forcing air or steam, or both jointly amongst the particles of molten crude iron prior to the congelation of the said liquid or melted metal in the form of pigs or otherwise is of course precisely Bessemer's claim of 17th Oct., 1855. Continued for a short time, Martien's process would slightly purify and decarbonise the crude iron and it might be moulded into pigs. By a longer continuation of his process the crude iron would be first steelified, and then reduced to the state of malleable iron *prior to congelation*, and would then be fitted not to mould into pigs, but *otherwise* into ingots.

Bessemer's claims, therefore, are not original, and in his specifications, he has claimed what is impracticable, so that they are manifestly invalid and untenable. (Signed) W. S. P.

2nd April, 1861.

◆

FASTENING ARMOUR PLATES.

Sir,—It appears that fastening armour plates on ships by means of bolts is a defective plan, inasmuch as the concussion produced by shot on the plates breaks off the nuts and bolt heads. I think this can be remedied by attaching to each plate a "flange" or "fin" of say two inches thick, twelve inches wide, and long enough to reach from the plate to the inside face of the wooden backing. To receive this flange or fin an aperture should be made in the wooden backing, about four inches wider than the thickness of the flange (say six inches)—when the plate is in its place, and the flange in this hole, it must be wedged in by wedges (of the same length and depth as the hole) of *dry compressed wood*, and as it is a fact that such compressed wood will when damp return to its original size, these wedges would swell out and not only fill up the hole water-tight but press the flange with such force as to hold it perfectly tight in its place. The flange may have a swelling on the inside end to assist its immovability. With such a fastening the support is distributed over a large surface and a strong bearing, while the elasticity of the wooden wedges would prevent any fracture or shaking loose of the holding flange by the concussion of shot on the armour plate. I should be glad if your correspondents would comment upon this plan.

Martyn Roberts.

Pendarren, Crickhowell, April 4, 1862.

◆

THE GREAT EXHIBITION BUILDING.

Sir,—I am surprised that you have published my communication upon this subject, as a vehicle (apparently) for passing an insult upon my writings in general, as you could either have suppressed it without any notice, or informed me that the building is a permanent one. As regards my lucidity of style, I am quite willing to put it to any competent individual, whether my communications have not *fewer* dubious passages than your articles, and hence, as compositions, are of greater merit; and concerning my knowledge I shall only say that, notwithstanding I have but seldom referred either to the inventions, discoveries, or observations of others, it would perhaps be found upon trial, that, as to science in general, I am as "erudite" as you are.

Yours, &c., J. Alexander Davies.

April 1, 1862.

Gossip.

◆

A machine has been invented by a practical steel engraver which promises to revolutionize the arts of metal engraving and cameo cutting. We have seen some of the results produced by this extraordinary specimen of mechanical ingenuity, and they are positively astonishing. The most elaborate medals of the celebrated engraver *Andrieu*, struck during the Consulate and the Empire of Napoleon I., have been copied by the new process with faultless precision, and in an incredibly short space of time. We have no hesitation in saying that the days of *hand* steel engraving are numbered, and that the occupation of cameo cutters by the ordinary process, will soon be gone. The engraving machine is likely to become, indeed, to the present art of engraving on steel, stone, or any other hard material, what the sewing machine has to needlework and embroidery. At present we are not at liberty to describe this wondrous apparatus, which, when once adjusted, may be worked by an unskilled labourer, or, in fact, by a seamstress. Ere long, however, we hope to give further information respecting it.

A cast-steel bell of unusually large proportions has just been successfully cast at Messrs. Naylor, Vickers and Co's. River Don Works. The bell is 7 ft. 6 in. in diameter, weighs 10,560 lbs., and is, we believe, the largest casting in steel ever made in Great Britain. The process of pouring the metal occupied eleven minutes. One hundred and twenty melting pots were used, each pot containing 60 lbs. of metal.

The obituary notices of the past week include the name of Mr. George William Wyon, a young and talented artist, who for some time previously had filled the office of acting resident engraver to the Royal Mint. His death causes a vacancy in the engraving department of that establishment, which should be most carefully and cautiously filled up. It is more than probable that ere many years—or perhaps months—elapse, a total remodelling of the British coinage may be begun, and it is essential in the highest degree therefore, that the Mint engraver should be an artist of first class ability. Much has been said in the House of Commons this week respecting the advantages or otherwise of competitive examinations for appointments in the Civil Service, but there can be no question that for the adequate filling of such a situation as that of Engraver to the Mint, a competitive examination is indispensable. Although in later times the Mint has had the benefit of the talent of such men as Pistrucci, and W. Wyon, it is notorious that since the days of the Charles's and the Commonwealth, when Nicholas Briot, and Thomas Simon flourished, there has been an "aching void" in the engraver's department of the English Money Manufactory. Probably Mr. Potts, or some other Member of Parliament as distinguished for his love of art, may suggest the propriety of inviting competition among the young artists of the nation, for the honourable office of engraver to the Mint.

Lord Clarence Paget was certainly at fault when he stated on Monday night last that a ship of war was *being* built on Captain Cowper P. Coles's cupola plan. The vessel which the Government *contemplate* building—and the Merrimac and Monitor duel may expedite their contemplations perhaps—will have no masts, and when prepared for action, will show nothing above deck but the tops of her iron shields, and her funnel. These shields will be furnished with heavy Armstrong, or other guns, and will be fixed up on a turn-table, which will be made to revolve with the guns, men, and materiel of war. Of course armour plates, of the latest and most approved shape and thickness, will protect the cupola war ship from the bolts of her antagonist, whoever she may be.

On Tuesday evening last, Mr. H. Berkeley asked the Secretary for War whether the construction of Armstrong guns was to be thrown open to competition; and of what calibre was the largest of those guns yet completed? Sir G. C. Lewis replied, that the War-office had no contract with Sir W. Armstrong, but it had a contract with the Elswick Iron Company, which had been printed in the index to the report on military organization. If that contract were referred to, it would be seen that if the War-office should cease altogether to employ the Elswick Company for the manufacture of ordnance, the Government would be bound to compensate that company for loss of profit on their plant to the extent of 85,000*l*. With regard to the second part of his hon. friend's question, as the subject was one at all events of temporary interest, he would read to the House a statement of the guns which were at present in use or in course of trial. The 110 lb. Armstrong gun, it appeared, was the largest as yet actually introduced into the service, and a large number had been supplied to her Majesty's ships and batteries at home and abroad. He now came to the experimental class. A 140 lb. gun, rifled on Sir W. Armstrong's patent, loaded at the muzzle, fired a solid shot of 140 lb. weight with a charge of 20 lb. of powder; the experiments with this gun had proved highly satisfactory. The next was a 200-pounder, a gun on the Armstrong principle, which was now in course of manufacture, and he expected would be ready in a month. The next was the 300 lb. rifled gun, which was undergoing a course of preliminary experiment; it had been fired with a spherical shot of 156 lbs., charged with 40lb. of powder, and a proposal had that day been brought forward by the Director-General of Ordnance for the manufacture of guns capable of firing a shot of 300lb., or, as a rifled gun, of 600lb. weight. In addition to these guns, one gun of 120lb. on Mr. Whitworth's principle, and one of 200lb. on Mr. Lynall Thomas's principle, were in course of construction.

At a meeting of the Board of Managers of the Franklin Institute, Philadelphia, held January 22nd, 1862. Mr. Howson, exhibited an improved Cannon-sight; also, a telescope for measuring distances, both invented by Mr. Altemus, of that city. The main advantages of the cannon-sight are its self-adjustability to the surface of the cannon, and the facilities which it affords to the gunner for taking a rapid and accurate aim; the telescope is provided with a glass disc, so graduated by means of a diamond, that the distance of any object, the height of which is known, can be readily ascertained. The lines made by the diamond on the glass disc take the place of the spider's web heretofore used, and cannot be displaced. A pocket-album for photographs, the invention of Mr. Altemus, of that city, was exhibited. The leaves holding the photographs are so hinged to each other, and to the binding, that a number of pictures may be shown and compared at the same time. Mr. Howson also exhibited a graduated glass measure, invented, by W. Hodgson, Jun., the graduations of which are formed during the operation of moulding. Also, a self-priming pistol, invented by Mr. Butterfield, being a revolver with a self-priming lock. This has been approved of by the military authorities, who have ordered a large number. Also, Mr. Andrews' tobacco-pipe. This has two chambers, separated by a grating on which the tobacco rests, the lower chamber serving as a reservoir for the nicotus, the upper chamber being detachable. Also, a portable writing case invented by Mr. W. T. Fry; this contains a very complete supply of such articles of stationery as may be needed in travelling and is well adapted for army use.

Capt. Ford, of the Thames Shipbuilding Company, in a letter to the *Times*, says:—"The exploits of the Merrimac having fully demonstrated that a vessel of war capable of using her prow as a means of offence is a much more formidable opponent to her enemy than an ordinary vessel which is not built with a running-down stem, it will doubtless be satisfactory to the public to know that our noble ship the Warrior, although now presenting the graceful outline and appearance of a gigantic yacht, is so constructed that, at the cost of a few hundred pounds, she may be converted into an irresistible ram, fully capable of running down any number of wooden ships, without injury to herself. It is only necessary to take away the overhanging cutwater, figurehead, &c., when a stem of gigantic proportions and enormous strength, forged and fitted with this object, will make its appearance, and to this the bow plates can be easily connected. The Merrimac, being a wooden vessel, received such considerable injury to her bow in running down and sinking the Cumberland as to oblige her to go into dock for repairs; but there are so many examples of iron vessels with stems vastly inferior in strength to the Warrior running down other ships without receiving any injury that no such fear need be entertained on her account.

On Monday last, Sir Frederick Smith, in accordance with the notice which he gave several days ago, called the attention of the House to the extraordinary naval combat which took place at Fortress Monroe between the Confederate iron-plated steamer the Merrimac, and the Federal Ericsson battery the Monitor. Having described the engagement, he expressed his conviction that it was decisive as to the uselessness of stone fortifications, and that, as a necessary consequence, the proposed forts at Spithead would, if erected, be an absolute waste of the public money. He also suggested whether iron-cased ships could not be employed at Portsmouth and elsewhere for purposes of defence. Mr. Laird and Mr Gregory followed in support of these views, the latter contending that the traditions of the past must be abandoned, and mail-clad vessels henceforth take the place of stone fortifications. Several other members having spoken, Sir G. C. Lewis declined at that time to consider suggestions which would revolutionise the British navy, and entail an enormous expense. Upon the particular question before the House, he said that the Defence Commission were of opinion that for the protection of Spithead a mixed system of defence was necessary—iron cased ships being employed in addition to the projected forts. For reasons which he gave, he did not consider that the action between the Merrimac and the Monitor was conclusive as to the qualities of those new vessels; and he was of opinion that in time artillery might be constructed which would be able to cope with them, and thus restore the equality between land and floating batteries. He promised that the subject should recei the best consideration of the Government. Bright considered that an unanswerable ca been made out for suspending the works, whi clearly proved to be unnecessary, and the Government, in justice to the taxpayers of ry, and in view of the increasing distr manufacturing districts, should pause ere they engaged in the two-fold expenditure which was being pressed upon them. Mr. Bernal Osborne and Sir J. Pakington both urged the importance of reconsidering the subject of fortifications; and after a further Ministerial explanation, from Lord Clarence Paget, and some remarks by Mr. Bentinck, Mr. Coningham, and other members, the subject dropped.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2259, 2296, 2321.
Boilers and their Furnaces, &c., 2255, 2258, 2305.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2256, 2261, 2266, 2290, 2297.
Ships and Boats, including their fittings, 2270, 2281, 2282, 2304, 2309, 2324, 2325.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2264, 2302, 2313, 2314, 2318, 2320.
Food and Beverages, including apparatus for preparing food for men and animals, 2274, 2279, 2321.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2253, 2267, 2268, 2275, 2291.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2271, 2273, 2276, 2312.
Lighting, Heating, and Ventilating, 2301, 2317.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2254, 2263, 2277, 2285, 2289, 2293, 2300, 2302, 2311.
Metals, including apparatus for their manufacture, *None*,
Chemistry and Photography, 2283, 2286, 2288.
Electrical Apparatus, 2292, 2303, 2310.
Warfare, 2260, 2284, 2298, 2307, 2315.
Letter-Press Printing, &c., 2322.
Miscellaneous, 2252, 2262, 2265, 2269, 2272, 2278, 2280, 2287, 2294, 2295, 2299, 2307, 2319.

2252. C. Cheyne. *Improvements in extinguishing fires in buildings, and in apparatus employed therein.* Dated Sept. 9, 1861.

This invention consists in extinguishing fire in warehouses, store rooms, and other buildings and apartments, by filling the apartment where the fire exists with carbonic acid, or other gas which is known to extinguish or prevent flame, by admitting such gas through a pipe or pipes provided with slide or other valves, which pipe is in communication with a bell or other reservoir containing a supply, or in which a supply can be readily generated and emitted, under pressure or otherwise. The invention also consists in preventing the influx of air into any apartment in which fire may exist, by simultaneously closing by means of slides or shutters all windows, chimneys, and other apertures communicating with the atmosphere. *Patent abandoned.*

2253. R. A. Brooman. *An improved method of producing mixed coloured woollen and other threads.* (A communication.) Dated Sept. 9, 1861.

In the spinning of filamentous substances, in order to produce mixed coloured threads, each shade or colour is dyed separately; the different coloured filaments are afterwards united and passed through preparing and spinning machines. Notwithstanding the greatest care to equalize the mixture of the colours, especially when they are opposite, such as black and white, there form and remain in the thread veins or stripes different from the ground. The object of this invention is to overcome this defect. The invention consists in dyeing or printing the filaments with "chinage" or marks of colours by any suitable means, upon parts of their length, in sections and in one or more colours, before being made into thread. *Patent completed.*

2254. W. E. Newton. *An improvement in the construction of boots and shoes.* (A communication.) Dated Sept. 9, 1861.

This consists mainly in the use of a shank, constructed of metal or other material of sufficient rigidity, and attached directly to the "insol" without the intervention of an insole. *Patent completed.*

2255. J. Anthony. *Improvements in steam boilers and generators.* Dated Sept. 10, 1861.

This consists in carrying and continuing the fire and smoke-boxes and flues or tubes of steam boilers to the top, or very near the top, of the inside of the boiler shed, or to any other position which may be found necessary, and in dividing the whole body of the tubes or flues into two, three, or more sections or nests of flues or tubes; these divisions are to be caused or formed by the placing or fixing of dampers or water spaces in or across the fire or smoke-boxes, so that the flame and hot air from the furnaces may be caused thereby to pass through a portion only, or one section or nest of flues or tubes at the same time, and to successively pass from back to front of the boiler, and *vice versa*, or from side to side, until the whole of the flues or tubes in all the sections or nests have been traversed, and thence into the uptake or chimney. The flues or tubes are to be of the same size and number in each section or nest, or increased or diminished as required. *Patent abandoned.*

2256. T. S. Tyson. *A lubricator applicable to corves or waggons.* Dated Sept. 10, 1861.

This consists of an enclosed vessel with chambers for holding one supply or discharge of the lubricant according to requirement, and having tubes for conducting the same where required. When this lubricator is applied to corves or waggons having a tipping action it is rendered self-acting. *Patent abandoned.*

2258. L. P. Barre. *Improvements in tubular steam boilers.* Dated Sept. 11, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2259. R. Restell. *Improvements in the means of connecting and disconnecting engines and tenders to and from trains.* Dated Sept. 11, 1861.

This consists in certain mechanical arrangements whereby the driver of a train is enabled to connect and disconnect the engine and tender to and from the train at will without leaving his place on the engine. *Patent abandoned.*

2260. W. L. Thomas. *Improvements in projectiles.* Dated Sept. 11, 1861.

This invention is described and illustrated at page 178 of the present volume of this Journal. *Patent completed.*

2261. J. Borons. *Improvements in railway wheels and railway breaks.* Dated Sept. 11, 1861.

These improvements in railway wheels consist mainly in forming a dovetail projection on the interior of the tyre, and in forming the spokes of the wheel of two discs or rings of wrought iron or steel, one being on one side of the wheel and the other on the other side. The rings are divided radially into segments, and the central portion of each segment is cut away to heighten the wheel; the larger or outer circumferance of each of the segments is turned up at an angle to fit into the dovetailed projection on the inside of the tyre; the smaller or inner circumferance of each of the segments of rings is also turned up to fit in recesses on each side the of boss, and the segments are connected to the boss by rivets or bolts passing through the boss and through the segments. The outer edges of the segments on the opposite sides of the wheel are drawn towards each other by bolts and nuts. *Patent completed.*

2262. G. H. Birkbeck. *Improvements in needles.* (A communication.) Dated Sept. 12, 1861.

This consists in forming the eye of the needle of a wedge shape, by nearly closing the sides of the eye towards the upper ends thereof, so that, when the sewing thread is drawn into this narrow part of the eye, it is securely retained thereby from slipping during the working, but by drawing it back into the wide part of the eye, the position of the thread can be readily changed. *Patent completed.*

2263. J. A. Dauncey. *Improvements in the manufacture of gloves, collars, and wristbands, to be worn as articles of clothing.* Dated Sept. 12, 1861.

This consists 1, in applying to collars of the ordinary make an outside fold or layer of silk or satin, figured or not. 2. In the use of a sheet of paper, to which is cemented a layer of silk or satin fabric, so that, when the collar or wristband is cut or stamped to the required shape and size, it presents a plain paper front on one side, and silk or satin on the other. 3. In making collars of india-rubber or gutta-percha, which can be japanned or enamelled, or varnished white or other color. 4. In making them of leather and morocco, and finished, japanned, enamelled, or varnished skins of animals. *Patent abandoned.*

2264. W. Stevens. *Improvements in mechanism or apparatus for ploughing and cultivating of the land by steam and other power.* Dated Sept. 12, 1861.

This consists essentially in the construction of a strong carriage made of wood or iron, supported on wheels, to travel from one end of the field to the other in a horizontal position, to which ploughs, cultivators, harrows, or rollers, may be attached, the whole being supported on a main shaft, across the centre from which the implements swing, and rise and fall to the land as required, by the rotating of the main shaft, that is worked by rack and pinion or lever, and forced into the earth at any depth required when in motion. *Patent completed.*

2265. C. Greaves. *Improvements in apparatus for preventing waste of water from service pipes or cisterns.* Dated Sept. 12, 1861.

This consists in the use of a closed air vessel which is supplied with water from any ordinary service pipe leading from the main, and is provided with a two way cock, which is so constructed that, when turned in one direction, it will enable a supply of water to enter the air vessel, and partially fill the same, the air contained therein undergoing compression, and when turned in another direction, it will shut off the supply entering the air vessel, and open the outlet from such vessel, the water then issuing therefrom with a certain pressure due to gravity, and the pressure of the air in the air vessel. *Patent completed.*

2266. A. Turner. *Improved apparatus for enabling the guards and drivers of railway trains to communicate with each other.* Dated Sept. 12, 1861.

This relates to an arrangement of rods, levers, and connecting links, which will enable a man at one end of a train to make signals to another man at the further end of the train, either by striking a bell, acting on a dial or index, or otherwise. *Patent abandoned.*

2267. M. A. F. Mennons. *An improved combination of machinery for the production of Valenciennes, Chantilly, Brussels and other similar laces.* (A communication.) Dated Sept. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2268. M. A. F. Mennons. *An improved combination of chemical and mechanical processes for the conversion of fibrous vegetable matters into paper pulp.* (A communication.) Dated Sept. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2269. W. W. Clay. *Improvements in knitting machinery.* Dated Sept. 12, 1861.

This invention is not described apart from the drawings. *Patent completed*

2270. W. E. Gedge. *Improvements in the nautical compass.* (A communication.) Dated Sept. 12, 1861.

The object here is to render the compass independent of magnetic influence on board ship, especially iron ships, and consists in placing beneath the card a number of magnetized needles, say twenty-four, but this number may be increased or diminished parallel to each other, and with their points directed, one north and south. *Patent abandoned.*

2271. J. Oliver. *Improvements in machinery for making bricks, pipes, and tiles.* Dated Sept. 13, 1861.

Here, upon a suitable frame, a hopper is mounted, into which the clay, in a raw state, is placed, and the bottom of the hopper forms a grating. In the hopper are placed several tilt hammers fixed on the extreme ends of levers working on a shaft mounted in the frame, and operated by cogs on a revolving drum, which depress the short ends of the said levers, and give motion to the tilt hammers in the hopper, by which means the clay and any small stones that are in it are pounded and forced through the said grating into a chamber under the hopper. In the front of the chamber is a spout through which the prepared clay is driven out on to a table by a horizontal hammer connected with an excentric, giving alternate motion to the same. A knife is fixed in front of the said spout for dividing the clay to the required breadth for the mould. The pressing machine receives the clay direct from the spout of the hopper on to a block, over which block slides a mould in which the bricks are formed under pressure of a punch or die connected to a powerful lever near its fulcrum. *Patent abandoned.*

2272. W. Davis. *The prevention of accidents arising from affrighted horses.* Dated Sept. 13, 1861.

This invention comprises much detail which cannot be given space to here. *Patent completed.*

2273. W. Farlar. *Improvements in sash fastenings, which improvements are also applicable to other purposes.* Dated Sept. 13, 1862.

This invention was described and illustrated in our last number. *Patent completed.*

2274. W. H. Delamare. *An improved machine for purifying and peeling corn.* Dated Sept. 13. 1861.

This consists in introducing the corn between the two roughened operating surfaces of a revolving cylinder or cone, and a stationary case or cover enclosing the cylinders. *Patent completed.*

2275. P. Dorbulk. *Improvements in weaving, for manufacturing figured or ornamented stuffs with treadle power looms.* Dated Sept. 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2276. R. Smith, B. Brooks, and J. Smith. *Improvements in the construction of roof and other lights* Dated Sept. 13, 1861.

Here the patentees form the bars and other parts where they support the glass with longitudinal recesses or gutters, over which the edges of the glass are laid, and the glass is then retained by putty in the usual way, or by other means. When from any cause the putty or other holding means admits water through it, such water after passing under the edges of the glass, in place of dropping at once therefrom, will be received into the longitudinal recesses or gutters, and by them may be conducted to suitable channels or receivers. *Patent completed.*

2277. G. C. Haseler. *Improvements in lockets.* Dated Sept. 13, 1861.

This consists, 1, in constructing ornaments with a secret ornament or inscription plate, or other ornamental design, placed between the lids or sides of lockets, so as to be hidden from view when the locket is closed, and to stand up and be exposed to view when the locket is open. 2. In the construction of lockets known as "book lockets," by securing portraits or other ornamental designs in frames without glasses when inserted through a slit or aperture, and in stopping up such slit or aperture by plates ,slides, or bolts. *Patent completed.*

2278. R. Fell. *Improvements in compressing and rarefying atmospheric air, with machinery for applying the same to obtain a motive power, part of which is applicable for cooking purposes.* Dated Sept. 13, 1861.

This consists in obtaining motive power by compressed air acting on water through cylinders and pistons, or acting directly from a hot air chamber in the driving cylinders. *Patent abandoned.*

2279. R. A. Brooman. *Improvements in machines for weighing and measuring corn and other grain.* (A communication.) Dated Sept. 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2280. T. L. Murray. *Improved applications of mica, previously coloured or metallized, to various useful purposes.* (A communication.) Dated Sept. 13, 1861.

The patentee claims the application of translucent sheets of mica upon all gilt, silvered, metallized, or coloured surfaces, so as to preserve the brilliancy and colour of the said surfaces; this smooth, unalterable, diaphanous coating, is further capable of being washed and cleaned. *Patent completed.*

2281. J. B. Howell. *Improvements in the manufacture of chains and chain cables.* Dated Sept. 13, 1861.

Here the inventor employs steel or iron, or a combination thereof, rolled of any required thickness and breadth, with one face concave and the other convex. The metal so rolled he forms into links of such shape as may be necessary, by coiling the strips of metal around in the centre, which corresponds with the interior of the link, and towards which the convex surface of the metal is turned, the convex face bedding continuously into the concave surface. These coils are built up to the proper substance when hot;

when sufficient contraction has taken place the ends are soldered or formed. *Patent abandoned.*

2282. C. Sutton. *Improvements in indicating the position of sunken ships or other such vessels.* Dated Sept. 13, 1861.

This consists in applying to ships a buoy or other body capable of floating, and in connecting the same to the ship by a rope capable of unwinding from a reel or similar apparatus, so that as the ship sinks, the rope will be unwound and allow the floating body to rise. *Patent completed.*

2283. H. Dixon and J. R. Renner. *Improvements in carbonizing saw dust and other vegetable substances.* Dated Sept. 13, 1861.

This consists in subjecting vegetable substances to the action of steam, by means of rotatory or other movable pipes or agitators. *Patent completed.*

2284. W. E. Newton. *Improvements in guns.* (A communication.) Dated Sept. 13, 1861.

This consists in an arrangement of parts, by which separate movable metallic cartridge chambers, charged with powder and ball, are successively and at regular intervals dropped from a hopper opposite to and held tightly in contact with a gun barrel of corresponding calibre. By this arrangement a constant firing from the cartridge chambers through the barrel may take place by turning a crank. *Patent completed.*

2285. G. Dixon. *Improvements in the manufacture of upholsterers' trimmings.* Dated Sept. 14, 1861.

This consists in the use of "ruche" in the manufacture of upholsterers' trimmings. *Patent completed.*

2286. J. A. Knight. *An improved apparatus for rendering fatty or oleaginous matters and delivering the same.* (A communication.) Dated Sept. 14, 1861.

This apparatus is so arranged that the fluid fat or oleaginous matter, as it becomes suitable to be drawn off, may be removed from near the upper surface. *Patent completed.*

2287. W. H. Crispin. *Improvements in the manufacture of curved and angular paper tubes and pipes.* Dated Sept. 14, 1861.

Here the paper used is coated with pitch or other bituminous material. This is done by reducing the pitch, &c., to powder, distributing it over the paper, and exposing such paper to hot metallic plates. *Patent abandoned.*

2288. R. Waller. *Improvements in machinery or apparatus for manufacturing and refining cane juice and other saccharine substances.* Dated Sept. 14, 1861.

This consists, essentially, in an arrangement of apparatus whereby the saccharine solution is exposed to a degree of heat which is never so high as the boiling point. *Patent completed.*

2289. W. Wheatstone. *Improvements in concertinas and other musical instruments, the tones of which are produced from the vibration of springs.* Dated Sept. 14, 1861.

The object here is the accomplishment of the following desiderata. 1. A more convenient method of supporting the instrument, and of actuating the bellows whilst using it, whereby the 3rd and 4th finger of each hand of the player can be released from the necessity at present existing of their use in that duty, so that they may be used in conjunction with the other two fingers of each hand in operating upon the finger studs or keys. 2. A more convenient position of the whole series of finger studs in the tops of concertinas and similar instruments. 3. An enlargement of the compass of the scales, without increasing the dimensions or materially altering the weight thereof. 4. A great extension of the scale of duet concertinas. 5. An improved quality of tone, by giving additional solidity to certain portions of the instrument. *Patent completed.*

2290. J. Led. *Improvements in self-acting signals for railways.* Dated Sept. 14, 1861.

This consists in an arrangement of levers, whereby the foremost wheels of the locomotive are caused to make the desired signal. *Patent abandoned.*

2291. J. King, and J. Satcliffe. *Certain improvements in or applicable to machines for spinning and doubling.* Dated Sept. 14, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2292. F. Barnett. *Automatic electric signals, to prevent collisions on railroads and railways.* Dated Sept. 14, 1861.

This consists in the use of an automatic electric button of partly solid form, which button contains plates of metal suitable for completing the circuit of electricity. The said buttons are to be used on railways, and are acted on by the flanges of the wheels, whereby the desired signal is given. *Patent completed.*

2293. M. A. F. Mennons. *An improved surgical instrument, applicable to the treatment of certain diseases of the urethral, vaginal, nasal, and other passages or cavities of the human body.* (A communication.) Dated Sept. 14, 1861.

This instrument is composed of a tube or rod, varying in form, material, and dimensions, according to its use, and having externally one or several longitudinal or spiral grooves, serving as receptacles or conductors to the medicinal substances which it may be necessary to convey into the diseased passages or cavity. *Patent abandoned.*

2294. A. Green and W. H. Glover. *Improvements in the manufacture of vice-boxes.* Dated Sept. 14, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2295. H. C. Jennings. *Improvements in treating hides and skins.* Dated Sept. 14, 1861.

We cannot here produce the voluminous details of this invention. *Patent completed.*

2296. G. Hawksley. *Improvements in traction and locomotive engines.* Dated Sept. 14, 1861.

This consists in a method of arranging traction and locomotive engines, whereby they may be rendered more capable of turning and passing round curves. *Patent abandoned.*

2297. W. E. Newton. *Improved apparatus to be adapted to carriages, for the purpose of checking or arresting their progress on inclines, or when going down hill.* (A communication.) Dated Sept. 14, 1861.

In railroad carriages, trucks, or waggons, in which the running wheels are usually keyed fast on to the axle, which rotates in suitable bearings, a strong ratchet barrel is keyed, or otherwise secured on the rotating axle; and 1, 2, or more palls are mounted on a transverse shaft, or attached to a strong beam, which is secured to the under framing of the carriage. These palls are capable of being lifted up away from the ratchet barrel when out of use, and if it be required to check the progress of the train, they may be instantaneously lowered, so as to take into the ratchet teeth of the barrel, and thereby prevent the axle-tree from rotating; the wheels will thereby be stopped, and by rubbing on the surface of the rails will create such an amount of friction as will quickly stop the train. *Patent abandoned.*

2298. T. Morris, R. Weare, and E. H. C. Monckton. *Improvements in batteries, for obtaining electric currents and the products therefrom.* Dated Sept. 14, 1861.

This consists in an arrangement of battery cells, whereby the plates or cells are not immersed, as is ordinarily the case, in a trough, and whereby the intensity of electricity is obtained more readily, and the electric current is less likely to escape. Also in the mode of producing the chemicals or excitants for the batteries; and also in the mode of making the cells and the divisions thereof; and also of the general arrangement of earth or mineral batteries, and the useful results obtained therefrom. *Patent completed.*

2299. T. Webb. *Improvements in tills or receptacles for money.* Dated Sept. 14, 1861.

This consists in so arranging the till (for security) that it shall represent a double drawer, one sliding within the other. The inner till has at its extreme end a catch lock, so that when the till is closed the inner receptacle becomes fastened. *Patent abandoned.*

2300. S. Horsley and E. H. Jones. *Improvements in apparatus for cleaning and polishing boots, shoes, and other coverings for the feet, partly applicable for cleaning plate and other articles of domestic use.* Dated Sept. 16, 1861.

This relates to those machines where circular brushes are made to revolve by a treadle, and consists in so making the brushes that when they are placed in position on the spindles or shafts they will form one continuous brush, the periphery of which will be alternately concave and convex. 2. In supporting the blacking or other polishing substance to the brushes by discs, arms, or vanes fastened to a spindle, resting on a framing placed in the receptacle or trough for containing the said blacking, &c., and which discs, arms, or vanes, can be brought into contact with the brushes at pleasure, to communicate the required quantity and no more. *Patent completed.*

2301. M. Rae. *Improvements in lamps.* Dated Sept. 16, 1861.

This consists in causing a current of air to impinge against the flame of a lamp, by means of a lamp, taper, light, or other heat producing agent placed within or under a tube or tubes communicating with the burner, which, on being lighted or heated, causes an upward current of air, which, coming in contact with the flame of the lamp, produces a white light. *Patent completed.*

2302. W. E. Gedge. *Improved apparatus for drying grain.* (A communication.) Dated Sept. 16, 1861.

This apparatus may be placed between two floors or stories. From the upper storey the grain is poured into a hopper or funnel, and after passing from cone to cone, moving by its own weight, it escapes at the lower storey through a shoot, which, by means of a small trap, regulates the rapidity of its passage through the apparatus. *Patent completed.*

2303. J. Reeves. *Improvements in electro-magnetic engines for obtaining and applying motive power.* Dated Sept. 16, 1861.

This relates to a previous patent, dated 22nd February, 1861 (No. 449), and consists in supporting a slotted ring or wheel on studs projecting from the fixed plate which supports the apparatus; and on this slotted ring or wheel holders are placed through which the wires from the galvanic battery and helices pass, and are brought in contact with another ring or wheel formed of non-conducting material, with spaces in the ring which hold conductors. This ring or wheel is attached to the driving wheel, and when in motion makes and breaks contact continually between the wires of the galvanic battery and the helices. The surface of the ring for making and breaking contact is prepared with sand or emery, so as to cause friction, and thus rub and clean the ends of the wires as they pass over it. *Patent completed.*

2304. T. Mkaiton. *Improvements in steering apparatus.* Dated Sept. 16, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2305. W. J. Hesketh and D. Parsell. *Improvements in steam boilers and furnaces, whereby better to adapt them to burn all kinds of coal, more especially anthracite or stone coal.* Dated Sept. 16, 1861.

This invention is not described apart from the drawings. *Patent abandoned.*

2306. W. Clark. *Improvements in the application of mica to ornamental and other purposes.* (A communication.) Dated Sept. 16, 1861.

This relates to the covering of all kinds of gilding, silvering, and other leaf metal surface colouring, and all kinds of decorations generally, with sheets of mica pasted or otherwise cemented thereon, which are thereby protected from the destructive action of exterior agents, at the same time presenting various metallic or coloured effects through the mica. *Patent abandoned.*

2307. G. Fay. *Improvements in sights for rifles and other fire-arms.* Dated Sept. 16, 1861.

Provisional protection has not been granted for this invention.

2308. W. Stewart. *Improvements in apparatus for supporting persons in and for enabling them to progress through the water.* Dated Sept. 16, 1861.

This invention consists in constructing and fitting to the body both in front and at back, an inflated waterproof bag, or other buoyant support, connected between the legs and over the shoulders; that part of the bag extending down the back possesses greater buoyancy than that extending down the fore part of the body. The buoyant support may consist either of air and waterproof vessels, or it may be composed of cork. In addition to the buoyant support the invention consists in attaching to each heel a paddle free to move within certain limits upon a hinge, and in some cases the patentee attaches similar paddles to the hands or wrists. When all the improved apparatuses are on a person he will be supported at a slight angle in the water, and by performing with the feet the motion as if ascending a ladder, aided by a paddling motion with the hands, he will be able to progress through the water. *Patent completed.*

2309. A. M. Skinner. *Improvements in propelling ships, boats, and other vessels.* (A communication.) Dated Sept. 16, 1861.

This invention consists in propelling ships, boats, and other vessels, by means of a new propeller working on a vertical axis, and placed within the timbers, one on each side of the midship section of the ship. The centre of the propeller is circular, and solidly constructed of wood and iron, with a transverse opening to admit of an iron or strong wooden blade or float traversing to and fro. Its axis is vertical, terminating in a conical point, working in an iron cup resting on the bottom of the ship, being placed eccentrically within an immovable elliptical iron ring above and below, so that, as the propeller revolves on its axis, the blade or float traverses to and fro through the transverse opening, in consequence of its edges moving round in contact with the inside of the elliptical ring, the blade or float acting like an oar in the water, being wholly or partially immersed, according to the trim of the ship; the blade or float is hung on suspension bars, and traverses to and fro with little or no friction. The propellers, of which there are two, one on each side of the ship, are placed at the centre of oscillation, and low down in the ship; they cannot be lifted out of water by the pitching and rolling of the ship. When the blade or float is fully exposed, it has a direct propelling power under circumstances in which ship is prevented by the side of the ship. *Patent abandoned.*

2310. R. A. Brooman. *Improvements in apparatus for stretching, supporting, and uniting telegraph wires.* (A communication.) Dated Sept. 16, 1861.

The apparatuses now in use for stretching telegraph wires, carry at each end a roller upon which the ends of the two wires are wound; this roller being solid, a third wire is requisite to unite the two wires. By the means about to be described a third wire may be dispensed with, and the part of the invention consists in forming the rollers with a slot extending to the axis, and in forming the axle of the rollers hollow from the point where the slot terminates. The ends of the wires are carried through the slots, and passing through the hollow axle are brought towards each other and are united in and by a clamp in which a wedge or wedges are inserted to jam the wires with a pressure screw for tightening up the wedges. The solid end of the rollers is provided with a ratchet-wheel and ratchet, and with a square or angular spindle, which, on being turned with a key, stretches and tightens up the wires as required. This invention also consists in stretching telegraph wires by means of pincers made with grooved jaws for gripping the wires: behind the jaws is a bar for uniting the jaws, while the legs of the pincers extend outwards from each other, the ends of the legs are united by two connecting-rods themselves; connected by a pin to one end of a bar, the other end of which terminates in an eye; a cord is fixed to this eye and is carried round a windlass or barrel. By turning the barrel, the legs of the pincers are pressed outwards, and the jaws are thereby tightened in the wire, and the strain being continued the wire becomes stretched to the extent required. The apparatuses for supporting telegraph wires consist of a fixed upright and of a jaw hinged to it; the upright and jaw are formed with grooves in which the wires are placed and supported; the two parts of the support are kept together by means of a screw. *Patent completed.*

2311. R. A. Brooman. *An improvement in shirts.* (A communication.) Dated Sept. 16, 1861.

This invention consists in making shirts with plain fronts which are not to be starched, and in furnishing the sides and bottom of the plain front with tabs or with other parts of fastenings, and in making false fronts with buckles or other parts of fastenings to correspond with those on the shirt. Thus the shirts and false fronts will each be provided with parts of fastenings, which, on being brought together, will make the attachment of one to the other complete. The fronts are made with gussets to fit over the shoulder, and are made to open in front like an ordinary shirt front; or the band may be made to open at the back or side of the neck. *Patent abandoned.*

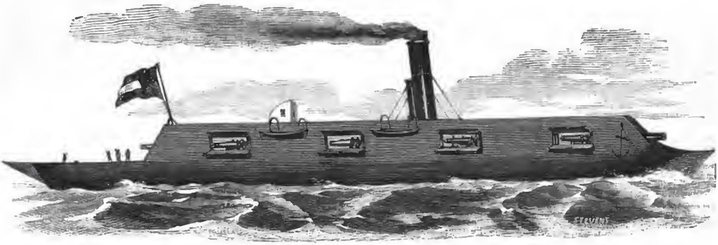
2312. F. M. Ransome and E. L. Ransome. *Improvements in treating stone, bricks, and other surfaces, and in the manufacture of filters.* Dated Sept. 16, 1861.

In treating stone, bricks, and other surfaces, the patentees employ powdered glass or other vitrified or hard substance, or powdered flint, stone or sand, mixed with soluble silicate, with or without colouring matter, the object being so to apply soluble silicate that it may for the most part be retained in combination with the pulverized substance on the surface of the material to which it is applied. The compound of soluble silicate and pulverized matter or matters having been applied to the surface of the stone, bricks, or other material, the soluble silicate is then rendered insoluble in like manner to that practised when impregnating stone or other substances with soluble silicate; but by this mode the pulverized matters will be combined with the silicate. *Patent completed.*

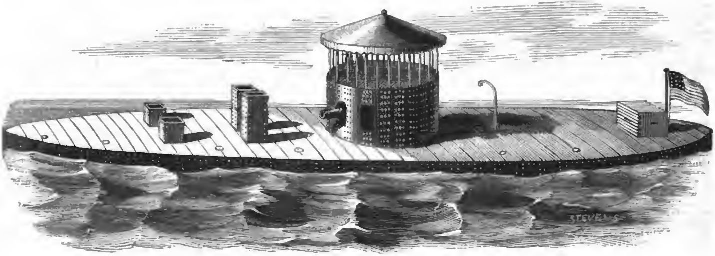
2313. W. Tuxford. *Improvements in thrashing machines, and in raising and stacking straw and other agricultural produce.* Dated Sept. 16, 1861.

The patentee, claims, 1, the elevating of grain and pulse by a partial vacuum formed by an exhausting or sucking apparatus. 2. The use of a perforated cone, and flat or dished

THE MERRIMAC.



THE MONITOR.



rudder passes the more freely through the aperture, the water on the opposite side being at the time depressed.

Figs. 5 and 6 represent single rudders, the aperture in the dead wood being cut through. A balance rudder is pivoted at or about the one-third-motion is given to the rudder by the application of a longitudinal rudder shaft fitted at a convenient distance below the screw shaft. Attached to the outer end of this shaft is a pinion, which, working on a quadrant secured to the rudder, or otherwise thread gear, with right and left screw secured to a yoke on the rudder—the shaft of which is kept water tight in a similar manner to the screw shaft. Close to the shifting box is fitted a drum-head with studs, so arranged to receive a flat link chain, and sufficiently large to admit of its passing up on either side the screw shaft, and connected in like manner to the steering apparatus on the lower or orlop deck.

Fig. 7 and 8 is fitted in like manner, the difference being that it is not a balance rudder, but is pivoted with rule joints on the extreme fore end, and is worked in like manner.

The steering apparatus would be a toothed quadrant fixed to the head of each rudder and acted on by a pinion wheel, to the shaft of which would be fitted the steering wheels. Fitted to the deck immediately beneath the quadrant would be a steam cylinder, made to the same radius as the quadrant above it, as shown in Figs. 9 and 10. A piston working through a slot or steam-tight aperture on the side of the radius cylinder would be so arranged that it could with ease be attached or detached to the rim beneath the quadrant for the purpose of steering the ship in heavy weather; this would be under the command of the helmsman, and so arranged that when the pressure was great on the wheel, by placing his foot on the foot plate, he would turn on a jet of steam from the boilers on to the piston, and assist him in steering the ship. The steam cylinder in the second arrangement would be differently arranged, and may be fitted below the deck, the piston of which would be connected to a crank in connection with the steering barrels.

The box auxiliary rudder is a contrivance to be used in extreme cases, for the purpose of bringing the ship's head to wind in severe weather and heavy seas, but for general use its adoption is not recommended.

THE MONITOR AND MERRIMAC.

THE MERRIMAC.

We lay before our readers this week, views of the "Monitor and Merrimac," which we have received from our American correspondent. It will be recollected that the frigate "Merrimac" visited our shores a few years ago, and laid in the Southampton waters, for a short time, while there she was visited by many naval authorities, and created a degree of interest, which ripened into a controversy, occupying many pages of our journal (Vol. 65), a reference to which would be highly interesting on the present occasion. The "Merrimac" was a first-class war vessel of the United States Navy; she was partially burned and then sunk in the Gosport navy yard, to prevent her falling into the hands of the "Confederates" shortly after the breaking out of the American civil war. The Confederates, after some difficulty, succeeded in raising her and plating her with railroad rails inclined at a sharp angle. This armour in a recent severe contest, seems to have afforded efficient protection against the heaviest artillery at very short range.

THE MONITOR

is an iron plated vessel, built at the Brooklyn Navy yard. The upper section of this vessel is in the form of a flat-bottomed scow, with sharp ends and vertical sides, 5 feet deep, 174 feet long, and 41 feet 4 inches wide. The central portion of the bottom is cut out for a length of 124 feet and a width of 34 feet, to communicate with the lower section, which is attached to the bottom of the scow, and which extends down with inclined sides to a depth of 7 feet 6 inches. The lower section is built of iron, the plates being ½ inch in thickness. The upper section is built very strongly of wood and iron, the vertical sides being of solid oak 30 inches in thickness, covered by one-inch rolled iron plates to the thickness of 6 inches. The propeller and rudder, being under the projecting end of the upper section of the vessel, are securely protected from shot.

The principal novelty of this vessel is the cylindrical revolving turret, in which the guns are placed. This is formed of rolled one-inch iron plates bolted together to the thickness of 8 inches; its internal diameter is 20 feet, and it is 9 feet high. It rests at its lower edge on a smooth, flat ring of composition metal, but when in action the principal portion of its weight is sustained by a central shaft, about which it revolves; a massive wedge being driven below the step of the shaft on such occasion to raise it, and thus cause it to bear up the turret. A large spur wheel upon the shaft is connected by a train of gearing with a small steam engine, which supplies the power for turning the turret.

THE GREAT EXHIBITION BUILDINGS.

BY WILLIAM FAIRBAIRN, LL.D., F.R.S., ETC., *President of the British Association for the Advancement of Science etc.*[*]

THE introduction of the use of iron in buildings has been a great desideratum for the last twenty years. For nearly a century, iron has been employed in the construction of steam-engines and machinery; and as improvements have from time to time been made in its manufacture, and confidence has been gained through experience in its use, it has gradually usurped the place of other materials in millwork, in shipbuilding, and for bridges. But its application to dwelling-houses and public buildings has been retarded by a want of the requisite knowledge on the part of architects and builders, and a determination in many quarters to resist its introduction as an innovation upon the good old practice of employing brick, stone, and timber, for such purpose.

To ensure economy and success in the introduction of iron as a building material, the architect should make himself acquainted with its properties in its cast and malleable state, and he must commit to memory certain facts which bear upon the comparative resisting powers of these two materials under various kinds of strain.

An example of the knowledge which is indispensable to architects and builders desirous to be considered proficient, will be found in the following data:—

	Tensile Strength per square inch in lbs.	Compressive Strength per square inch in lbs.	Transverse Strength per square inch in lbs.
Cast Iron.	16,500	112,000	40,000
Wrought Iron	51,600	38,000	42,000

Thus, it will be observed, that whilst the *tensile* strength of wrought-iron is three times as great as that of the cast metal, its resistance to crushing is only about one-third as great; and these facts point to the effective and economical employment of wrought-iron as ties, and in similar cases where tensile forces have to be resisted, and to the use of cast-iron for columns and framework, where the desideratum is to withstand the power of compression.

Again, the architect must be aware of the different arrangements necessitated by the varying properties of these materials. A cast-iron beam, for example, should have its bottom flanch[†] six times the area of the top one, or, in practice, at least four times, to suit the convenience of casting. On beams of *wrought*-iron, on the contrary, a different arrangement is necessary, the area of the top flanch requiring to be nearly double that of the bottom,—to attain a maximum power of resistance. In large wrought-iron girders for bridges, the construction is again modified by the introduction of tubes or cells in the upper flanch, as in the Conway and Britannia bridges, when the areas should be proportioned in the ratio of 11 to 12. Again, it should be understood, that the strength of girders of similar proportions increase as the squares of the span, whilst their weights increase as the cubes of the span.

With these preliminary observations, it may be interesting to glance cursorily at the history of the application of iron to constructive purposes down to the present time, when it is most strikingly exemplified in the works in progress at South Kensington.

The exact time when cast-iron came into use appears to be very uncertain, although for the casting of cannon and other purposes it has been employed from an early date. It was not, however, till 1794 that John Rennie applied it successfully to millwork, in the machinery of the Albion Mills, Southwark. It was employed for bridges as early as 1777, by Mr. Pritchard, at Colebrook Dale.

The first notice we have of its application to buildings, was the use of cast-iron beams at Messrs. Philips and Lees's cotton mill in Salford, in 1801. These beams extending from wall to wall, were supported in the middle by cast-iron columns and carried brick arches to form the floors, which were consequently fireproof. For half a century this same principle of construction has been successfully followed and applied to nearly the whole of the factories of Lancashire and Yorkshire.

In the use of cast-iron there is, however, a hidden source of danger, arising from flaws in the castings, want of proportion, &c., and several serious and fatal accidents have resulted from this cause, as well as from ignorance of the properties of the material. Hence we earnestly recommend the more extensive application of wrought-iron in every case where tensile strains have to be resisted. The breakage of cast-iron beams not only involves the destruction of property, but, what is far more serious, a great sacrifice of life, of which the accident at the Hartley Colliery is a fearful example; and this question is, we believe, at the present moment engaging the serious attention of the Legislature.

The first house entirely built of iron was, we believe, constructed by the writer's firm, at Millwall, London, in the year 1840. It comprised a flour-mill, three stories high, with cast iron pilasters at the corners and sides, with intermediate plates of sheet-iron. The interior was plastered upon wire gauze, leaving a space of three-inches between the plaster and the external plates, to secure uniformity of temperature within. This mill was constructed in sections, and shipped, along with its steam-engine and machinery, to Constantinople, where it still exists. In subsequent years some few houses were constructed of corrugated iron plates, and the discovery of the gold mines in California and Australia created a considerable demand for these, so that hundreds of houses, and even churches, warehouses, &c., were despatched to these remote countries.

Such was the history of our iron constructions up to the year of the Great Exhibition of 1851, when a new era in the application of iron dawned upon us, taking its rise in a rude sketch executed by Sir Joseph Paxton whilst travelling from Chatsworth to London. It is well known with what success this unique structure of glass and iron, so happily conceived, was ultimately erected. This was the first colossal building of iron; next followed the Crystal Palace at Sydenham, and subsequently the Art Treasures Exhibition of Manchester, and the Exhibition at Paris, of the same material.

These structures are, however, likely to be eclipsed by the gigantic buildings of the same character in progress at South Kensington; and it is in reference to these that we shall now attempt, without entering into a scientific analysis, to give some reliable data which may afford to our readers a clear perception of their magnitude, and of the purposes for which they are destined.

The deep interest which the lamented Prince Consort always took in every movement calculated to promote the education and improve the condition of the people of these islands is proverbial; and his increasing desire to raise the standard of taste in the industrial as well as the fine arts is so well known, that his premature removal has been universally regarded as a national calamity. It is no wonder, therefore, that the nation looks forward with some anxiety and with great hope to the success of the forthcoming Exhibition, as a kind of memento of the services and encouragement which have been lost to it through that heavy bereavement with which it has been visited, in common with her Majesty.

In the building itself, which covers an area of nearly twenty-five acres, will be found articles of every possible description, and her Majesty's Commissioners have spared neither labour nor expense in making ample provision for the extraordinary demands that have been made upon them. It was found, however, that seven times the space provided, gigantic as that is, would be required to meet all the demands of the exhibitors, and the Commissioners have been compelled reluctantly to cut down the allotments, in many cases, to one-third or one-fourth of what was required by exhibitors.

The most prominent feature of the original design prepared by Captain Fowke, was a Great Hall, 500 feet long, 250 feet wide, and 210 feet high, behind the principal entrance on the south side. The cost of the building, as then estimated, was £500,000, which exceeded the means that the Commissioners could reasonably expect to have placed at their disposal, and the Great Hall was, therefore, abandoned. The general plan of the present design consists of a great nave with transepts at each end, whilst at the intersection of these are the two immense domes, which form the chief features of the east and west fronts. The nave is 800 feet long, 85 feet wide, and 100 feet high, or four feet less than the great central transept of the Exhibition of 1851. It is supported by coupled cast-iron columns, fifty feet high, and at distances of twenty-five feet apart, on which rest the great arched ribs of the roof, and the horizontal girders of the galleries.

The picture galleries, the finest and most extensive in Europe, are permanent buildings of brick, 50 feet wide and nearly 1,200 feet long. They extend the whole length of the Exhibition facing the Cromwell-road, and form a magnificent series of apartments. The principal entrance to these spacious galleries is through a hall, 150 feet long by 110 feet wide, leading to the inner courts, and also to the stairs which conduct to the galleries above, and diverge from the entrance on either side.

(To be concluded in our next.)

Law Reports.

YOUNG'S PATENT FOR THE MANUFACTURE OF PARAFFIN AND PARAFFIN OIL.

IT may be remembered that about a year ago, an application was made to the present Lord Chancellor, then Attorney General, on the part of Mr. Gillespie, of Torbanehill, for his Fiat, to enable Mr. Gillespie to issue a writ of Scire Facias to repeal Mr. Young's patent. Mr. Young's process of obtaining paraffin and paraffin oil by the distillation of bituminous coal, by which paraffin became for the first time a commercial product, is now well known. It is carried on in a very extensive scale, and many tons of the oil and solid paraffin are produced by Mr. Young and his partners, at their works, near Bathgate, in Scotland, every week. The coal chiefly employed in the manufacture is the Boghead coal, and the field from whence that article is obtained, is owned in part by Mr. Gillespie. The price of Boghead coal at the time Mr. Young obtained his patent was 13s. 6d. per ton, whilst it is now about 40s. It is therefore surprising that it should be conceived by Mr. Gillespie, that the patent which has really created his wealth is injurious to him; his argument appears to be, that the demand for his coal—which he calls the Torbanehill mineral—is restricted so long as the manufacture of paraffin oil from it is confined to the proprietors of Mr Young's patent, and that if the patent could but be got rid of, it would be an incalculable advantage to him. Proceedings in different shapes have been accordingly adopted by him in Scotland to evade or quash the patent. First, by seeking to obtain a decision, that the Torbanehill mineral, as he terms it, was not a coal but a shale, and therefore that it might be used for obtaining paraffin oil notwithstanding the patent. In this, however, he signally failed. Next by commencing an action of Declarator and Reduction in Scotland, which is a similar proceeding to the action of Scire Facias in England, for the purpose of repealing the Scotch patent, and concurrently with this an application for a Scire Facias to repeal the English patent. He was, however, equally unsuccessful in his then application to the present Lord Chancellor, as he refused the fiat, upon the grounds that Mr. Gillespie was at that time the pursuer of an action in Scotland, in which he was directly challenging the patent; and that he would not allow any application for a writ of Scire Facias, which ought to be made for public purposes only, to be made with a view to promote any private end or interest, and also because no ground in his opinion had been laid before him for granting the writ at all, and that he did not read the English patent as interfering, as Mr. Gillespie alleged it did, with the sale in England of the mineral product possessed by that gentleman in Scotland.

Subsequently to this, Mr. Gillespie abandoned the proceedings he had instituted in Scotland to repeal the Scotch Patent, and commenced them *de novo* in July of last year, and pending these new proceedings he has most unaccountably applied again to the present Attorney General for his Fiat for a writ of Scire Facias to repeal the English Patent. Counsel appeared on both sides, Mr. Aston for Mr. Gillespie (instructed by Messrs. Simson and Traill) in support of the application, and Mr. Webster and Mr. W. N. Lawson, of the Chancery Bar (instructed by Mr. J. Henry Johnson), to oppose it in behalf of Mr. Young. The reasons for the application delivered in on behalf of Mr. Gillespie were on this occasion in an amended form in certain particulars, viz., that instead of alleging that Mr. Young was not the inventor of the "use" of bituminous mineral substances for obtaining paraffin oil, it was now charged that he was not the inventor of the "improvements in the treatment of certain bituminous mineral substances and in obtaining products therefrom, as described in the specification of his Letters Patent." But without going into this question the application was again refused, the Attorney General remarking that he would not grant his Fiat for any writ of Scire Facias, so long as there was a proceeding of that kind pending in connection with the same invention, and that it was very rash on the part of Mr. Gillespie to take the Scotch proceedings, and that as it was through his fault that Mr. Young was there to resist that second application, Mr Gillespie must pay Mr. Young his costs.

---

[*] From the popular Science Review.

[†] The flange or flanch is the projecting ridge at either side of the beam.

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

March 18th.—J. C. Dyer, Esq., Vice-President, in the chair.

Dr. Joule made a communication "On the Probable Cause of Electrical Storms."

The very close correspondence between the theoretical rate of cooling in ascending and the actual indicates a rapid transmission of the atmosphere from above to below, and *vice versa*, continually going on. We may believe that during thunderstorms this interchange goes on with much greater than ordinary rapidity. At a considerable distance from the thundercloud, where the atmosphere is free from cloud, the air descends, acquiring temperature according to the law of convective equilibrium in dry air. The air then traverses the ground towards the region where the storm is raging, acquiring moisture as it proceeds, but probably without much diminution of temperature, on account of the heated ground making up for the cold of evaporation. Arrived under the thundercloud, the air rises, losing temperature, but at a diminished rate, owing to the condensation of its vapour to form part of the immense cumulus cloud which overcasts the sky on these occasions. The upward current of the air carries the cloud and incipient rain drops upwards, but presently, in consequence of the increased capacity of the mass from the presence of a large quantity of water, the refrigeration of the air, in consequence of its dilatation, will be so far diminished as to prevent the condensation of fresh vapour, and ultimately to re-dissolve the upper portion of the cloud. This phenomenon, which has been noticed by Rankine in the cylinder of the steam engine, will account for the defined outline of the upper edges of cumulus clouds. The upward current no doubt extends occasionally to regions below the freezing temperature. If cloud be carried with it, snow or hail will be formed, which, if sufficiently abundant, will pass through the cloud and fall to the ground before it is melted. Now, the dry cold air in which the snow and hail are formed is a perfect insulator. Ice has also been proved, by Achard, of Berlin, to be a non-conductor and an electric. Even water, in friction against an insulator, is known from the experiments of Armstrong, explained by himself and Faraday, to be able to produce powerful electric effects, and this fact has been suggested by Faraday to explain powerful electric effects in the atmosphere. Sturgeon has noted the remarkable development of electricity by hail showers. Few heavy thunderstorms occur without the fall of hail. Hail, whether in summer or winter, is almost, if not invariably, accompanied with lightning. In the presence of these facts it seems not unreasonable to consider the formation of hail as essential to great electrical storms; although, as has been pointed out by Professor Thomson, very considerable electrical effects might be expected from the negatively charged air on the surface of the earth being drawn up into columns, and although, as the philosopher has observed, every shower of rain gives the phenomena of a thunderstorm in miniature. The physical action of insulators and electrics in mutual friction must certainly produce very marked effects on the grand scale of nature. If we suppose that the falling hail is electrified by the air it meets, the electrification of the cloud into which the hail falls might thus be constantly increased until the balance between it and the inductively electrified earth is restored by a flash of lightning. If the hail is negatively electrified by the dry air with which it comes in contact, the latter will float off charged with positive electricity, which may account for the normal positive condition of the atmosphere in serene weather, as well as the electrification of the upper strata evidenced by the aurora borealis. The friction of wind has been supposed by Herschel to contribute to the intense electrification of the cloud which overhangs volcanoes during eruption.

Dr. Calvert also read a paper "On the Employment of Galvanized Iron for Armour-plated Ships."

The author stated that no doubt many gentlemen present were acquainted with the fact that he had been for some time past engaged in ascertaining the chemical composition of various woods employed and susceptible of being employed in the navy. On a recent visit to one of the dockyards he found that while the armour-plates were fixed against a layer of teak, the ribs of the ship were of oak, and that the iron bolts which were to fasten the plates were to pass through the oak ribs. It occurred to him that the inconvenience which would probably result from the action of the oak upon the iron might be obviated by substituting galvanized iron bolts for those now in use, and he therefore instituted a series of experiments, the results of which he had great pleasure in laying before the meeting.

The first series of experiments consisted in having driven through large pieces of oak, bolts and screws of iron and galvanized iron prepared by his friends, Messrs. Richard Johnson and Brother, of Dale street, Manchester, which were then immersed in soft and sea water for the last three months. The results clearly showed, first, that the friction did not remove the zinc from the galvanized iron; secondly, that the oak and galvanized bolts were unchanged; whilst in the case of the iron bolts, they were much rusted, and the pieces of oak had become quite black by the formation of tannate and gallate of peroxide of iron. During the experiments the waters were changed every week, and those containing the galvanized iron appeared unchanged, whilst in the case of the iron, they had a dark blue-black appearance, owing to the formation of gallate and tannate of iron.

In order to ascertain the comparative action of soft and salt water upon iron and galvanized iron when in contact with oak under identical circumstances, he made the following series of experiments.

Plates of galvanized iron having 18 inches of surface lost during three months the following weights:—

	soft water.	sea water.
Plate No. 1	0.10 grains.	——
" No. 2	0.11 "	——
" No. 3		0.095 grains.
" No. 4		0.090 "

Similar plates of iron lost during the same time.—

	soft water.	sea water.
Plate No. 1	1.23 grains.	——
" No. 2	1.52 "	——
" No. 3		2.40 grains.
" No. 4		2.38 "

There can, therefore, be no doubt that galvanized iron offers great advantages, the action of water on it being less than a tenth of the same action on ordinary iron. As there is no doubt that iron when galvanized is in the most favourable electrical condition to resist the action of oxygen, being in an electro-negative condition, it follows that in all probability the use of galvanized iron would be very advantageous in armour-plated and other iron ships. The author hoped that Government, and other large ship builders, would avail themselves of this suggestion, and make experiments on a large scale to verify the results he had obtained.

Telegraphic Intelligence.

Telegraphic Communication with Ireland.—The Electric and International Telegraph Company's new submarine cable, for connecting England with the South of Ireland, has been successfully laid between the coasts of Pembroke and Wexford, in perfect working order. The cable, manufactured by Glass, Elliot, and Co., is 63 miles in length, contains four conducting wires, insulated with gutta percha and other materials on the latest improved methods, and is protected by 12 heavy iron strands, the total weight being 6½ tons per mile. The novelty introduced in the manufacture has been the coating of the entire cable with a composition (Bright and Clark's patent) for the purpose of protecting the iron from corrosion and decay, and the adoption of this principle is likely to have a most important influence on the further progress of submarine telegraphy as tending to insure the durability of cables for an indefinite period, and to render investments of capita in such undertakings of permanent value. The Electric Telegraphic Company purpose using the same composition in the cable to be shortly laid between England and Holland. Mr. Canning, of the firm of Glass Elliot, and Co., superintended the arrangements for paying out the Irish cable from the steamer Berwick.

THE ATLANTIC TELEGRAPH.

Within the last month the American Government have made liberal overtures to our Government on the subject, and the Atlantic Telegraph Company have officially intimated their readiness, in the event of receiving a comparatively moderate guarantee, to embark a second time in the work of laying down a cable between the two continents. With the view of drawing particular attention to the increased facilities now presented for its accomplishment, Mr. Samuel Gurney, M.P., the director of several telegraph companies, and who has for some years taken a deep interest in the science of electric telegraphy, gave a *soirée* of a novel and interesting character on Wednesday evening last week, at his residence, Prince's-gate, Hyde-park. Here, for the first time, perhaps, a gentleman's private dining-room was brought into instantaneous communication with nearly all the principal capitals of Europe, as well as with Malta, Alexandria, and the East, the Submarine Company having for the occasion connected their great Continental lines with the house by means of the underground wires of the London District Telegraph Company, which run under the Kensington-road.

The experience gained within the last few years with regard to the submersion of submarine cables has almost reduced the carrying out of the Atlantic scheme to a mere question of fine weather. It is proposed to lay down the new cable over the same route as before, between Ireland and Newfoundland, a distance of 1,640 nautical miles. That this may be done with permanent success the existing telegraphs in active operation would seem to clearly demonstrate. The Government cable from Malta to Alexandria, by way of Tripoli and Bengasi, is 1,535 miles long, and therefore not far short of the stretch between Newfoundland and Ireland. Again, the cable between France and Algeria—520 miles in length—is submerged in water of equal depth to any in the Atlantic, while the bottom of that part of the Mediterranean is marked by the same great inequalities which are seen in the Alps. According to the statement of Messrs. Glass, Elliot, and Co., the contractors, all the cables made and laid by them, amounting to 3,918 miles of insulated wire, are, with two trifling exceptions which can be easily repaired, in excellent working order. It is a curious fact that though hundreds of patents have been taken out for different kinds of cable, the original spiral form of twisted wires for the outer covering, originally adopted by Mr. J. W. Brett, keeps its ground. India-rubber is advocated by some as the best insulator; but gutta percha is found to combine the advantage of durability with pliability, is easily repaired, and has never been known in any case to decay under water. The first submarine cable—that laid in 1851 across the Channel to Calais—is still in admirable working order, and in as good a condition as when originally used, notwithstanding it has frequently undergone repairs, in consequence of being broken by ships' anchors.

The capital required for the Atlantic telegraph is £700,000, and the company, we believe, ask the English Government to guarantee them 4 per cent. upon that amount for a period of 30 years. Mr. Seward has intimated officially to Mr. Adams, the American Minister here, that Mr. Lincoln's Government will be prepared to ask Congress for half of the guarantee, but in the present uncertain state of affairs across the Atlantic the company desire to have the 4 per cent. entirely guaranteed by England. If, however, America, kept her engagement, and France could be induced to join in the liability, the cost of the guarantee to each nation would be but a trifle, looking to the immense advantage which would accrue to all from an instantaneous interchange of communications. So anxious are the American Government to co-operate in the undertaking, that, although the route proposed will give Great Britain the entire control of the cable at both ends, they have expressed their readiness to ensure the inviolability of the telegraph even in the untoward event of a war between the two nations. What will be the result of this fair and generous offer it is impossible to say, but Lord Palmerston stated to a deputation which lately waited upon him that he would take the matter into his serious consideration. The chief obstacle in the way of the Government making the concession is the outcry recently raised against Government guarantees to private companies; but surely, if they were ever necessary or justifiable, it is in a work of such vast national and international value. It is intended, if the Government accede to the proposals made to them, to commit all the details, including the selection of the particular form of cable, to a body of scientific and practical men, half of whom are to be appointed by the Government. Messrs. Glass, Elliot, and Co. are confident that the two points can be connected by a good and durable cable, and have offered to contract for the work, and to stake a large sum upon its success. In a similar spirit the Gutta Percha Company not only agree to take the contract, but to guarantee the efficient and satisfactory working of the cable. Messrs. Glass, Elliot, and Co. suggest that the shore ends should be composed of very heavy wires, as all the accidents to their cables have been caused by ships' anchors, none of those beyond anchorage ground having ever cost one shilling for repairs, and they add that the cable which they would make for the Atlantic would be an improvement upon all others, and would, when once laid, be imperishable. It is calculated that, if this cable were effectually laid, by the aid of the improved transmitting machines as many as between 8 and 12 words a minute might be sent between Ireland and Newfoundland. Another route, by way of Iceland, Greenland, and Labrador, has been projected by the North Atlantic Telegraph Company, but while it would have the advantage of a cable consisting of a series of lengths, any one of which could be replaced without affecting the other, on the other hand, it would be exposed to risks from which the Mid-Atlantic wires will most likely be entirely free. In the first place, it is extremely doubtful whether the telegraphic instruments, when exposed to the peculiar magnetic influences of the atmosphere in the Arctic Regions, would work with sufficient certainty to render them at all useful; while in the next, it would be difficult to so dispose of the ends of the cables as to preserve them against the thousands of floating icebergs which crush against the shore in certain seasons, and destroy everything they come in contact with. Whether these formidable difficulties can be overcome is a point for the decision of electricians and other scientific men, but the preponderance of opinion appears still to be in favour of an unbroken line from shore to shore.

We gave a description of the cable recommended by Glass, Elliot, and Co. in our last Number.

The Submarine Telegraph Company, who placed their wires at the disposal of Mr. Gurney and his friends, have 22 lines to the Continent, including through routes to all the European capitals. They transmit on an average between 1,000 and 1,500 messages daily; but then they possess the only direct lines to the Continent, *via* France, Belgium, Hanover, and Denmark, exclusive privileges having been granted the company from these Governments for a period of thirty years. This has been objected to as a monopoly; but they contend that it has enabled them to give the public the benefit of a cheap and ready communication with the whole of Europe. In spite, however, of the company's extensive telegraphic ramifications the Commissioners of the International Exhibition, with singular perversity, deny their existence, having excluded them from the building, although they have offered to pay a heavy rent for an office within its walls.

The *soirée*, held at Mr. Samuel Gurney's last week, was attended by a distinguished and brilliant company numbering over 200 persons. The electric instruments were fixed upon a table in the dining-room and worked by the most skilful manipulators in the service of the company. Being made upon Morse's ingenious principle, now generally used, the answers received, instead of being indicated upon a dial, were printed upon long strips of paper in a species of simple short-hand. The alphabet consists of combinations of only two marks—a long line and a short one—which are produced by different degrees of electric fluid pressing down a roller, covered with ink, on the paper. The ears of the operators, however, get so accustomed to the electric ticks upon the machine, that without looking at the tape they can frequently tell the nature of the message. Wonder was depicted in the face of many of the ladies and gentlemen present when they saw the replies to their messages being distinctly and quickly printed in this way by electric sparks discharged from the most distant European capitals. The Earl of Shaftesbury sent along the wires to St. Petersburgh an inquiry as to the health of the Emperor of Russia, and in four minutes he received word from the banks of the Neva that he was in good health. The wires were then connected on to Moscow, Kiev, Myslowitz, Vienna, and Trieste to Verona, making an unbroken circuit of about 6,000 miles, through which messages passed as quickly as though the distance was only a few miles. The Lord Lieutenant of Ireland was communicated with by the wires of the British and Irish Magnetic Telegraph Company, working direct to Dublin, and he speedily sent back a few congratulatory words about the *soirée*, and expressing a hope that if the Atlantic cable were laid again it would take its start from Valentia. Another message was transmitted to Maynooth, addressed to Lord Otho Fitzgerald, telling him what was taking place. He soon responded, with a wish for the success of the entertainment, and inquired whether any ladies were among the guests. A lady at once volunteered a reply, viz., that the *soirée* would not be complete without the presence of the ladies.

Later in the evening the greater portion of the company assembled in the drawing-room, when

The Hon. Mr. Stuart Wortley made a few remarks in explanation of the object which had brought them together. Mr. Gurney, he said, having long taken a deep interest in the science of telegraphy, more especially submarine or ocean telegraphy, and being a member of the Atlantic Telegraph Company, was anxious to spread information on the subject among all classes, but chiefly among educated and intelligent persons, such as he addressed. Many looked upon the Atlantic telegraph as a myth, or doubted whether any message had passed along it between the two continents; but what was the fact? During the three or four days the cable was in operation, not only did messages pass, but some of the utmost importance. He spoke not of the complimentary messages which passed between her Majesty and the President, although such messages between the first magistrates of the two great nations were not without their significance and importance, but of practical communications, which were attended by most remarkable results. In the first place, news of the highest value from China having reached this country in an incredibly short time, was at once sent from the shores of Ireland to North America, and became known in New York almost as soon as in London. Again, a telegram was received in relation to the reported collision on the banks of Newfoundland between the steamers Europa and Arabia, which had caused great anxiety and distress to the relatives and friends in this country of those on board. He held in his hand the actual strip of paper or ribbon on which the message was printed in short-hand characters by the electric current, together with the translation. On a more recent occasion there was a report that the Parana, conveying troops to Canada, had gone down, and that all the hands had perished. How useful would a telegraph have been in such a case, in allaying the excitement. He believed that the Atlantic cable had actually been the means of saving to the English Government between £40,000 and £60,000. During the Indian mutiny orders had been sent to Canada for two regiments to embark for India. In the meantime, however, good news as to the probable suppression of the mutiny reached this country, and a message was sent by the Atlantic cable countermanding their embarkation; consequently the whole expense attending the voyage of two vessels, besides all the risk to the life and health of the troops on so long a voyage, were saved. He would say nothing as to the future, except that those most competent to form an opinion on the matter were confident that a cable could be successfully laid across the Atlantic. The undertaking would not only be an incalculable advantage to this country, but to humanity itself. Since the first cable failed most remarkable progress had been made in the science of submarine telegraphy as regarded the manufacture of cables, the question of insulation, and the instruments by which the messages were transmitted. The best proof of that had been given that evening, when messages had been received from the most distant parts of Europe. They also saw by that day's newspapers that the telegraph messages sent to overtake the Indian mail had reached it at Jabal, where they were placed on board the packet. Moreover, they were in correspondence with Algeria, the cable to which, across the Mediterranean, passed over a route very nearly resembling that proposed to be taken by the Atlantic Company. The Atlantic route was 1,600 odd miles long, and the depth of the sea 2,400 fathoms, while the route to Algeria was 600 miles long, and the sea from 1,600 to 1,800 fathoms deep. The Algerian cable, even at that depth, was taken up in consequence of a knot having occurred in it, and the knot having been cut the cable was reunited, and replaced without any difficulty, and was now in complete working order. It was a great mistake to suppose that submarine cables had generally failed; on the contrary, they had nearly arrived at a state of perfection in their construction and the mode of laying them down. Mr. Wortley concluded his observations by exhibiting the original message, by the Atlantic telegraph, containing the President's reply to the Queen's message, received at Valentia, on August 19, 1858. Like the other it was on a narrow strip of paper, and printed in blue ink by means of Morse's apparatus.

Mr. Cyrus Field briefly adverted to the success of submarine cables in America, and expressed a confident opinion that the Atlantic project would be effectually carried out, and with every prospect of a rich return to those who embarked their money in it.

Mr. C. F. Varley, chief electrician of the Electric Telegraph Company, said the matter resolved itself into two points—the question of insulation, which was a vital one, and the speed of communication by the cable when submerged; but upon neither of these did any doubt now prevail. When the Atlantic cable was laid electric telegraphy was in its infancy, but it had now attained a great degree of perfection. He ventured to say that if, 15 years ago, any one had said he would be able to communicate instantaneously between a gentleman's drawing-room in London and St. Petersburg, he would have been set down as a madman. With regard to the manufacture of cables, Mr. Varley said that gutta percha was the substance hitherto successfully used for insulating the conducting wire from the ocean, and that since the failure of the Atlantic cable the Gutta Percha Company had done all in their power to discover by what means it could be made better adapted for the purpose. Their labours had been attended by results far beyond their expectations, because they had succeeded in almost destroying its porous quality. The great fear was lest gutta percha, when sunk to an enormous depth in the Atlantic, would be penetrated by the sea water, but experiments showed that insulation improved as the pressure of the water increased. The pressure rendered the gutta percha less porous, and consequently, instead of injuring the cable, tended to insure its safety. As to the question of speed in the transmission of messages, the experience derived from the telegraph from Malta to Alexandria had set at rest the doubts of scientific men, and he had himself constructed an instrument which proved the theory which Professor Thompson had deduced by mathematical calculations upon that point. The expense of linking the Old World with the New would be small when the results were fully estimated. If they took into account the loss occasioned by the recent suspicion of a war with America, the injury done to business, the depreciation of stock, the stagnation of trade, they would find that the money value of that loss during the long period of suspense would have bound Europe with America twenty times over. Sufficient prominence was not given to the fact that a very large number of messages were sent by the Atlantic Telegraph before its failure. The cable was worked from the 18th August to the 1st September, 1858, and during that time 271 messages, or 2,885 words, were sent from Newfoundland to Valentia, and 129 messages, or 1,474 words, sent from Valentia to Newfoundland. The instruments used were capable of conveying four words a minute, but those proposed to be used for the new cable would probably operate with four times the speed.

Mr. Cassell asked what prospect there was at present of a communication being established between England and America.

Mr. Wortley said that a most remarkable overture had been made by the American Government to her Majesty's Government, with a view to obtain their co-operation in laying down the cable. It was not confined to any particular company, but it might be supposed that the American Government were friendly to the plan of the old company, inasmuch as the gentlemen they had sent over, Mr. Cyrus Field, was connected with that company. The proposal was still before Her Majesty's Government, and he was not able to go into details with regard to it; but he saw no reason why the despatch of the American Government should not be laid before the public. It showed the most friendly disposition on the part of that Government towards our Government, and a strong desire to remain on peaceful terms with this country.

Mr. Pease, M.P., said, supposing the English agreed to the arrangement, how long would the company be in making and laying down the cable?

Mr. Wortley said the great fault in connection with the first cable was the anxiety of all to get it laid down in a very short time. That cable was made by eminent manufacturers; but they were hurried in the work; and although no blame attached to them, the defects which caused the failure arose from the ill-treatment the cable received owing to that hurry. This was shown by the specimens of the cable which had been taken up from the sea. With regard to the question, he could not give a precise answer without consulting his colleagues; but they did not contemplate laying it down in the coming summer. He had already applied to Her Majesty's Government to employ ships in surveying the route—more especially the first few hundred miles from each shore—and he trusted that in the following summer they would make a successful attempt to lay it down.

Mr. Pease asked if they intended to take the old route.

Mr. Wortley said it was their opinion, after much deliberation, that the old route, which had at least been proved practicable, was the best. That was the conclusion of the best scientific and practical men on the subject; but the point still remained open for discussion.

Mr Kinnaird thought that whatever doubt might be entertained as to the Government giving a guarantee, there could be none as to their granting the use of surveying vessels.

Mr. H. E. Crum Ewing, M.P., said there could be no difficulty in raising the capital if the Government gave a guarantee, and he thought that even those members of Parliament who were loudest in their cry against subsidies to steam-packet companies would be in favour of one for an Atlantic cable.

In reply to Mr. Cassell,

Mr. Wortley said that the proposition which the company made to the Government was to a certain extent confidential, but he might state that the sum they asked as a guarantee was utterly disproportionate to the enormous importance of the scheme. If the English Government joined in the guarantee with the American Government, and even extended the convention to France, which he thought would, under the enlightened guidance of the Emperor, readily concur in it, and perhaps to other maritime Powers, the expense to this country would be trifling; and, in fact, they might be enabled to lay down more than one cable. It was highly creditable to the American Government that they offered to support the telegraph, although both ends were entirely on British territory, and to secure its neutrality in the event of war.

Mr. Adams, the American Minister, who had been alluded to by Mr. Wortley, said: On the part of the United States, I entirely reciprocate the spirit in which Mr. Wortley and others have spoken. I believe that such a project would be for the interest of both countries, but for many reasons it seems to me obviously proper that Great Britain should take the initiative in the matter. All I am authorised to say on behalf of the Government of the United States is, that they will co-operate in any plan proposed by the Government of Great Britain, having great confidence in their judgment, and believing that they will not adopt any plan without mature consideration. (These liberal sentiments of his excellency elicited warm applause.)

At the conclusion of this conversation the guests retired to the dining-rooms for refreshment, and it was past twelve o'clock before many began to take their departure; and just as the company had separated the following interesting despatch arrived direct from Alexandria, which was sent from there at 12.20 a.m., and arrived at Hyde-park at 1 a.m., occupying only 40 minutes in its transit from Egypt to Mr. Gurney's drawing-room:—

"The Prince of Wales leaves Cairo for Alexandria to-morrow, and leaves for Jaffa and the Holy Land on Friday. He is highly delighted with his visit to Egypt and the Nile trip. He has had good sport and is quite well.

"The Duke and Duchess of Saxe-Coburg and suite leave Suez, per Odin, for Massowah, on a shooting excursion.

"The Japanese ambassadors left Alexandria at 6 a. m. on the 25th, per Himalaya, for Marseilles. They intend first visiting France.

"The Viceroy is ill at Kafir-el-Mis.

"There is no political news here.

"The weather is fine, and staff all well.

"Mr. Gurney's nephew, Mr. E. N. Buxton and wife, left Alexandria for Syria on the 24th."

Mr. Montague Wigzell, of Topsham, Devon, has recently perfected and applied a means of ventilating railway and other carriages, which is spoken of as a decided success. It would seem that this is done by a japanned contrivance with double apertures, placed where the ordinary sliding apparatus is now found, and which takes up no more room, but fits exactly into the vacancy made by the removal of the latter. A vacuum is caused in these chambers by the motion of the carriage, and the foul air is drawn from the top of the compartment and supplied at the same rate. There is not the slightest perceptible draught observable during this operation, and if it should provide for the exigencies of the coming summer and satisfy the varied caprice of the travelling public, one source at least of grumbling will have been removed from John Bull's category of grievances.

plates, for packing the grain or pulse from the air entering into the exhausting apparatus. 3. The curved passages formed by the projections in the conical case for preventing grain rebounding to the centre. 4. The carrying and elevating straw or other fibrous substance between two sieves of endless ropes, bands, or chains, or upon a series of endless ropes, bands, or chains, running under stretched ropes, bands, chains, or wires. 5. The drawing straw, &c., along a trough with inclined or curved sides by an endless band or chain, to which are attached forks or tines. *Patent completed.*

2314. B. Samuelson. *Improvements in harvesting machines.* Dated Sept. 17, 1861.

This invention relates to harvesting machines having an upright shaft revolving to one side of, and in a line or thereabouts with, the cutters, such shaft being furnished with rakes or sweepers which enter the uncut crop at the proper inclination, cause it to meet the knives, and when cut sweep it to one side and release themselves from it at the proper time. Now the patentee has found that it is desirable that the rakes or sweepers should remove the crop at frequent intervals, and although this may be regulated by the velocity communicated to the upright shaft, yet he finds that it is preferable to diminish the distance between the rakes or sweepers which traverse the platform, and he effects this by causing three rakes or sweepers, at the least, at each revolution of the upright shaft to travel by means of guides in such a path and to extend so low that they shall remove the crop to one side after it is cut; and he interposes between such rakes or sweepers other sweepers which are so arranged as to bring the uncut crop towards the cutters, but not interfere with it after it is cut. *Patent completed.*

2315. P. Wrigley. *Improvements in the construction, manufacture, and mode of securing armour for the protection of ships and fortifications against projectiles.* Dated Sept. 17, 1861.

This consists in making the armour of metal distributed in the cellular form, and in filling the cells with wood or other material, or compound material possessing similar properties of elasticity. The patentee prefers to distribute the metal so as to form upon a plate a connected series of hexagonal spaces or cells, the metal forming the divisions between the spaces or cells. He manufactures the armour plates from metal having the qualities of soft homogeneous wrought iron, which is obtained by "Bessemer's" process, forming the armour plates by pouring the moulten metal into suitable moulds, and annealing them if required. He secures the cellular armour to the sides of the ships, &c., by fixing thereto ribs of iron of the T or other shaped section, between which the armour plates are introduced, the flanges of the ribs thus holding the said cellular armour plates in their places without bolts or other fastenings. *Patent completed.*

2316. F. Barrett. *An improvement in the light given by street and other lamps by means of reflectors, in which earthenware, china, and all enamel materials, in conjunction with an improved chimney to draw up the exhalations and smoke of all lighting materials.* Dated Sept. 17, 1861.

This consists in improving the light given by street and other lamps, by a reflector, which is to be made either of china, white earthenware, &c., answering the desired purpose; that is to say, possessing the power of well reflecting the rays of light, resisting the heat of the flame, and remaining unimpaired by the smoke and pernicious exhalations arising from gas or other lighting materials. These reflectors are to be made in all shapes, forms, and sizes. *Patent completed.*

2317. J. Eastwood and J. B. Joyce. *Improvements in machinery or apparatus for combing wool and other fibrous substances.* Dated Sept. 17, 1861.

This invention has reference to a patent granted to Mr. J. H. Johnson, 26th April, 1859, according to which the fibrous substances are taken by nipping instruments from gill combs used to feed the wool, and the present improvement consists in forming and substituting a vertical nip in place of the radial one. *Patent completed.*

2318. F. J. C. A. G. d'Olincourt. *A new system of cultivating land, and for preventing the disastrous effects of inundations.* Dated Sept. 17, 1861.

This consists in a system of cultivation whereby the land is so disposed that the rain water is used for the purposes of irrigation. *Patent abandoned.*

2319. G. Davies. *Improvements in machinery or apparatus for the manufacture of horse-shoe and other nails.* (A communication.) Dated Sept. 17, 1861.

This consists in forming an apparatus whereby horse-shoe or other nails are rolled and forged simultaneously. To obtain this, sectors are used, serving the purpose of rolls, which form the stem or body of the nail, drawing it out to the required dimensions, while the head is forged by a punch actuated with great rapidity. *Patent completed.*

2320. J. Statham and W. Statham. *Certain improvements in machinery or apparatus for mowing and reaping.* Dated Sept. 17, 1861.

This relates, 1, to a novel form of framing of the machine, which is made of "angle iron." 2. To the cutters, which are secured beneath a horizontal bar, and have a traversing action given to them by suitable gearing from the driving wheels. 3. To two bent metallic bars to which the bar of the cutters is attached, and which is supported at a certain point above the axle, instead of upon the axle as usual. 4. To the novel use of a blast of air produced by a fan, and conducted by an air tube. *Patent abandoned.*

2321. J. Lee and B. D. Taplin. *Improvements in traction engines.* Dated Sept. 17, 1861.

We cannot here quote the voluminous details of this invention. *Patent completed.*

2322. A. H. Bailey. *An improved system of combination types, and an improved case for containing the same.* Dated Sept. 17, 1861.

This consists in so combining in pairs those letters of the alphabet that are capable of being used together that the compositor shall have within his reach not only the letters which he requires, but also, that letter joined with the one which follows it, by which he is enabled with the single motion to set a type or letter to set two letters, and thus greatly facilitate the work. *Patent abandoned.*

2323. G. White. *Improvements in apparatus for filtering or purifying water or other liquids.* (A communication.) Dated Sept. 18, 1861.

This consists in making use of thin porous filtering partitions, formed of any suitable mineral, vegetable, or animal substance, according to the nature of the liquid to be filtered. These partitions may, for instance, be thin slabs of natural or artificial filtering stone, with or without carbon in its composition, a thin layer of a felted, woven or any other suitable fabric or product, which slabs or layers, by their thinness, would not offer sufficient resistance to the pressure exerted on them by the liquid if they were not, as according to this invention, carried or supported and cemented on proper frames, grates, or railings, forming a casing for the apparatus. The said slabs are fitted together edgewise, so that each filtering partition acts independently of the adjoining one. *Patent completed.*

2324. J. G. Briggs. *Making fire-proof buildings, ships, and other constructions.* Dated Sept. 18, 1861.

This consists in making buildings fire-proof by opposing to the progress of the fire, water placed between the walls, floors, and ceilings. A pipe is provided for the exit of steam. *Patent abandoned.*

2325. W. Cory, Jun. *Improvements in vessels and machinery for unloading colliers and other vessels containing coals.* Dated Sept. 18, 1861.

This consists in combining a suitable construction of floating vessel or platform with proper cranes or weighing machinery, together with rail or tramways, in order that vessels containing coal may come alongside whilst barges are on either side of both ends of the vessel or floating platform; and when desired the coals in descending into the barges may be screened by screens placed at each end of the vessel or floating platform by which the cranes and machinery are carried. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Nov. 18, 1861.

2893. P. Andre, J. F. Plinefaurie, and J. P. Richard, Bordeaux, France. Improvements in machinery or apparatus for preparing or manufacturing fuel.

Dated Dec. 17, 1861.

3165. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in machinery or apparatus commonly called gins, for cleaning cotton from seeds.

Dated Jan. 4, 1862.

35. H. D. Pochin, Salford, manufacturing chemist. Improvements in the manufacture of rosin, soap, or size.

Dated Jan. 13, 1862.

93. W. E. Gedge, 11 Wellington-street, Strand. Improved means or apparatus for gaining or acquiring motive power. (A communication.)

Dated Jan. 20, 1862.

145. A. Lamb, Southampton, and J. White, Isle of Wight. Improvements in life-boats.

Dated Jan. 29, 1862.

235. W. Clark, 53 Chancery-lane, engineer. Improvements in the disintegration and bleaching of textile materials for the manufacture of paper. (A communication.)

Dated Jan. 31, 1862.

257. H. Schalten, Hesse Cassel, C.E. Improvements in the manufacture or construction of gas meters.

Dated Feb. 1, 1862.

279. W. Clark, 53 Chancery-lane, engineer. Improvements in machinery or apparatus for the manufacture of festooned edging or material. (A communication.)

Dated Feb. 4, 1862.

289. T. M. Meekins, LL.D., Inner Temple, esquire, barrister at law. The production of a projectile and explosive force to be used in instruments of war, for an electric-gas gun and electric-gas shell, for a method of using the recoil of weapons, for the purpose of increasing the pressure of elastic fluids for the production of a projectile force, for a method of rapidly loading weapons at the breech, and of a motive force to be used in an electric-gas engine or other engines.

Dated Feb. 7, 1862.

323. J. Lloyd, Donnington, Shropshire, engineer. Improvements in buffers for engines and carriages on railways.

Dated Feb. 10, 1862.

347. W. Clark, 53 Chancery-lane, engineer. Improvements in reflectors. (A communication.)

349. W. Clark. 53 Chancery-lane, engineer. Improvements in refining cast-iron, wrought and other malleable iron, and in the cementation of iron. (A communication.)

Dated Feb. 13, 1862.

389. G. C. Burrows, Stoke Holy Cross, Norfolk, yeoman. Improvements in lounges, seats, or other apparatus for sitting or reclining on, which improvements are also applicable to rocking horses.

Dated Feb. 19, 1862.

435. C. T. Marzetti and J. Watson, Vine-street, Minories, E.C. Improvements in machinery or apparatus for raising, lowering, and otherwise moving or disposing casks and other bodies.

Dated Feb. 21, 1862.

459. J. Spence, Liverpool, merchant. Improved apparatus for transhipping and discharging grain and other substances, and for weighing, screening, and fanning such grain and substances during such transhipment and discharge. (Partly a communication.)

467. W. McAdam, pottery and glass manufacturer, and W. Chrystal, mariner, Glasgow. Improvements in sheaves or pulleys, journals, bushes and other similar bearing or rubbing surfaces.

Dated Feb. 22, 1862.

469. H. Chavasse, manufacturer, T. Morris, manufacturer, and G. B. Haines, Birmingham, agent. An improvement or improvements in the manufacture and ornamentation of metallic bedsteads, part of which is also applicable to other articles.

471. W. H. Ross, Liverpool, merchant. Improvements in the manufacture of sugar. (A communication.)

Dated Feb. 24, 1862.

489. R. Waller, Baker-street, Portman-square, C.E. Improvements in machinery and apparatus for joining leather and flexible and textile materials, and for the manufacture of boots and shoes and other coverings for the feet.

Dated Feb. 25, 1862.

499. J. Carnaby, 7A Skinner-street, City, manufacturer. Improvements in turning, managing, and regulating the taps and valves of gas pipes.

Dated Feb. 26, 1862.

516. A. Green, Rose Cottage, North-road, Forest-hill. Improvements in the method of and apparatus for bordering paper envelopes and cards with black or coloured borders.

519. G. Rees, Goswell-road, engineer. Improvements in the construction of marine sub-ways.

Dated Feb. 28, 1862.

551. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in the manufacture of hats and bonnets. (A communication.)

Dated March 1, 1862.

555. J. Sim, Aberdeen, manufacturing chemist. Improvements in the construction of gas meters.

556. H. C. Muller, Russell-place, New North-road, furrier. Improvements in the manufacture of imitation bear skin caps.

559. P. J. Guyet, Paris, C.E. Improvements in taps or valves.

Dated March 3, 1862.

578. T. Tillam, Church-street, Deptford-green, crematine manufacturer. An improved method of purifying gas.

Dated March 4, 1861.

585. J. Gjers, Middlesborough, York, engineer. A material or sand for the formation of moulds for casting iron and for other like purposes.

586. J. Ellis, Petersham, farmer. Improvements in hooks and swivels for fastening chains of all sizes and for other similar purposes.

592. G. H. and H. R. Cottam, St. Pancras Iron Works, Old St. Pancras-road. Improvements in horticultural buildings and other glazed structures.

Dated March 5, 1862.

595. J. Sidebottom, Harewood, near Mottram, Chester, cotton spinner and manufacturer. Improvements in fire-arms and ordnance and in projectiles.

597. J. and R. M. Somervell, Netherfield, Westmoreland, and M. Blanc, Birmingham. Certain improvements in the manufacture of boots and shoes.

599. J. Chubb, St. Paul's Churchyard, patent lock and safe manufacturer, and H. M. Burton, John's-place, Holland-street, Southwark, engineer. Improvements in apparatus for displaying or exhibiting jewellery and other valuable articles in glass cases.

601. E. Partingdon, Heap-bridge, Lancaster, manager. Certain improvements in the method of cleansing and preparing rags or other materials used in the manufacture of paper, and in machinery or apparatus connected therewith.

603. W. E. Newton, 66 Chancery-lane, C.E. An improved process and apparatus for reducing wood, straw, and other vegetable substances to pulp for the manufacture of paper. (A communication.)

Dated March 7, 1862.

607. J. G. Shipley, 181 Regent-street, saddler and army accoutrement maker. Improvements in bridle-heads, reins, and bits.

609. T. Parrimond, Manchester, mining engineer. An improved safety cage for mines.

613. T. Ball, W. Ball, and J. Wilkins, Broadway, Nottingham, manufacturers. Improvements in the manufacture of warp fabrics in warp machines.

616. R. Restell, Croydon, watchmaker. Improvements in apparatuses for connecting and disconnecting carriages and engines on railways, as also signal lines between guard and driver.

617. T. H. Wood, Blackweir, gentleman. Improvements in apparatus employed in the manufacture of artificial fuel.

Dated March 8, 1862.

621. G. Edmondson, Queenwood, Southampton. Improvements in washing machines.

623. W. Paterson, W. A. Sanderson, and R. Sanderson, Jun., Gala Mills, Galashiels, Selkirk. Improvements in finishing woven fabrics.

627. W. N. Wilkins, St. John's Wood, artist. Improvements in the manufacture of pigments for oil and water colours.

629. S. Grice, Birmingham, engineer. An improvement or improvements in propellers, for propelling ships and boats and other vessels.

631. W. Palmer, Bell House, Southweald. Improvements in the manufacture of candles.

633. P. N. Gisborne, 3 Adelaide-place, London-bridge, engineer and electrician, and H. Wickens, 4 Tokenhouse-yard, gentleman. Improvements in the means of indicating the presence of fire damp or choke damp in mines, and of dispersing fire damp, and also of telegraphing in mines.

635. F. R. Newton and H. Codd, Esher-street, Westminster. An apparatus for indicating and measuring the flow of liquids.

Dated March 10, 1862.

687. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in breech-loading fire-arms. (A communication.)

641. W. Parker and G. H. Batman, Copmanthorpe, York. Improvements in steam engines.

643. W. J. Bennett, 21A Millbank-street, Westminster, manager. An improved solution or preparation to be used with Portland and other cements for the production of artificial stone, or for building purposes.

645. W. S. Nosworthy, 79 Coleman-street, pianoforte manufacturer. Improvements in upright and horizontal pianofortes.

647. J. B. G. M. F. Piret, 29 Boulevart St. Martin, Paris, C.E. Improvements in lubricating apparatus.

649. M. Henry, 84 Fleet-street. An improvement in preparing hooks and hooks and eyes for sale or consumption. (A communication.)

Dated March 11, 1862.

651. R. Peacock, Manchester, manufacturer and printer. Improvements in the manufacture of window blinds.

653. P. Parfitt, Drury-lane, wine merchant. A watch protector.

655. E. Humphrys, Deptford, engineer. Improvements in steam engines.

657. E. G. Camp, Bristol, hairdresser. Improvements in brushes or apparatus for brushing.

660. H. Baynes, Clements-lane, City. An improvement in bankers' cheque books.

661. R. Smith, Glasgow, manufacturing chemist. Improvements in telegraph posts.

663. W. Clark, 53 Chancery-lane, engineer. Improvements in apparatus for effecting submarine operations. (A communication.)

Dated March 12, 1862.

664. A. R. Le M. de Normandy, Odin Lodge, King's-road, Clapham-park. An improved method of connecting gas and other pipes.

667. W. H. Latham, Bolton, foreman, and F. C. W. Latham, printer. Certain improvements in machinery or apparatus for perforating and numbering paper or other substances to be employed as tickets or where other counter registration is required.

669. A. Watson, Glasgow, plumber and brassfounder. Improvements in hot-pressing apparatus.

671. W. Conyers, Leeds-bridge, Leeds, currier and leather merchant. Improvements in currying leather.

675. W. Clark, 53 Chancery-lane, engineer. Improvements in the manufacture of coloured inks. (A communication.)

677. J. E. Grisdale, 73 Oxford-street, photographer. Improvements in photographic cameras, and in the mode of fixing the lens therein.

679. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the manufacture of cartridges. (A communication.)

Dated March 13, 1862.

688. J. Howard and J. Bullough, Accrington, Lancaster, ironfounders and machine makers. Improvements in warping and beaming machines.

692. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in apparatuses for measuring and regulating the flow and pressure of gas, parts of which are applicable to hydraulic receivers and to steam generators. (A communication.)

700. J. Kent, Moscow, hosier. Improvements in cleansing and bleaching. (Partly a communication.)

Dated March 14, 1862.

706. L. Gabler, 41 Bernard-street, and M. Zingler, 14 Granville-street. Improvements in manufacturing articles from ivory and bone.

708. A. J. Paterson, Edinburgh, gentleman. Improvements in the construction of telegraph cables.

Dated March 15, 1861.

712. W. Clark, 53 Chancery-lane, engineer. An improved telegraph cable. (A communication.)

720. H. Y. D. Scott, Brompton Barracks, near Chatham, captain in the Royal Engineers. Improvements in the manufacture of cement.

722. J. Avery, 26 Mark-lane. Improvements in purifying coal. (A communication.)

724. J. Robey, 49 Hereford-road North. Improvements in manufacturing and refining sugar, and in apparatus employed therein.

726. J. T. Pendlebury, blacksmith, and T. Pendlebury, mechanic, Bury. An improved form of lubricator.

Dated March 17, 1862.

730. W. B. Lord, Plymouth, veterinary surgeon Royal Artillery, and F. H. Gilbart, Brixton, gentleman. Improved means or apparatus for raising, lowering, and releasing ships' boats or other heavy bodies.

732. W. Bowser, Glasgow, engineer. Improvements in ships' fire hearths or boiling and cooking apparatus.

734. J. and W. Weems, Johnstone, Renfrew, engineers. Improvements in apparatus for indicating the pressure or quantity, and in regulating the discharge of fluids.

736. W. Barford, Peterborough, agricultural implement maker. Improvements in rollers for rolling land.

738. G. T. Bousfield, Loughborough-park, Brixton. Improvements in cranks for driving sewing machines and other machinery. (A communication.)

740. J. Hicks, Hatton-garden, meteorological instrument maker. Improvements in mercurial barometers.

744. T. Myers, Brighton, gentleman. Improvements in meters for measuring water, gas, or other fluids.

Dated March 18, 1862.

748. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. An improved needle threading apparatus. (A communication.)

752. W. Tongue, Bradford, engineer. Improvements in machinery and in processes for preparing, heckling, dressing, and combing flax, hemp, silk, and other fibrous materials.

756. J. A. Ronketti, 31 Northampton-road, Clerkenwell, meteorological instrument maker. Improvements in meteorological instruments and thermometers.

758. S. Slack, West-street, New Sneinton, Nottingham, lacemaker. Improvements in the manufacture of stockings and other fabrics in circular knitting machines.

760. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in the manufacture of barytes and barytic products, and the application of these substances in the manufacture of sugar, and other uses. (A communication.)

Dated March 19, 1862.

762. A. Krupp, Essen, Rhenish Prussia, cast steel manufacturer. Certain improvements in the method of manufacturing shafts for steam boats and other purposes.

764. S. Desborough, Noble-street, St. Martin's le Grand, manufacturer. Improvements in the manufacture or construction of sewing or other needles.

766. S. Moore, Liverpool, millwright, engineer, and iron founder. Certain improvements in machinery for compressing and cutting tobacco.

768. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in reproducing or in producing copies of guipure lace, embroidery, and other like articles. (A communication.)

770. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in apparatuses for drawing in and paying out chain cables, applicable to windlasses and capstans. (A communication.)

Dated March 20, 1862.

776. R. M. Roberts, Kensington, mining engineer. Improvements in obtaining and applying motive power.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

818. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Certain improvements in machinery for the production of ornamental stitching or embroidery. (A communication.) Dated March 24, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2890. J. M. Clements. Manufacturing garments.
2893. P. Andre, J. F. P. Faurie, and J. P. Richard. Manufacturing fuel.
2895. M. D. Rogers. Chain cable stopper or controller.
2904. J. Lee. Wheels.
2915. J. C. Croxford. Fastening doors.
2916. W. Bayliss. Extinguishing conflagrations.
2917. F. Puls. Treating fatty and oily matters.
2923. J. H. Jeffs. Wearing apparel.
2928. W. E. Newton. Rotary engines. (A communication.)
2931. A. F. Yarrow and J. B. Hilditch. Steam carriages.
2933. R. D. Clercq and E. Chazelles. Raising and supplying water to boilers.
2939. W. Evans. Motive power.
2941. J. Weems. Coating or plating metals.
2948. W. Bray. Locomotive apparatus.
2950. F. D. Wylde. Paper-making machinery. (A communication.)
2952. J. B. Hulard and L. G. Poupel. Hardening stone.
2957. W. Burgess. Reaping and mowing.
2960. J. H. Johnson. Cleaning grain. (A communication.)
2964. P. Cowan. Re-burning animal charcoal.
2969. R. Harcourt. Knobs.
2981. F. F. Dumarchey. Crushing and pounding stones.
2989. A. V. Newton. Mowing and reaping. (A communication.)
2991. W. Clark. Electric telegraph bell apparatus. (A communication.)
2994. M. Henry. Manufacture of soap. (A communication.)
2995. W. Rowan. Heckling and scutching vegetable fibres.
3006. B. Pitt and J. J. Shedlock. Cocks or valves.
3011. S. Tonks. Steam boilers.
3018. J. W. Gibson. Ordnance.
3040. H. G. Hacker. Fabrics.
3042. R. Kennedy and J. Armstrong. Driving gear.
3053. M. Henry. Printing and ornamenting fabrics. (A communication.)
3087. W. Clark. Gloves. (A communication.)
3093. J. A. J. Redier. Watches.
3094. V. L. Daguzan. Paving.
3120. J. D. Jobin. Locomotive engines.
3196. W. Clark. Manufacture of matches. (A communication.)
3227. G. H. Birkbeck. Connecting apparatus. (A communication.)
3239. T. Silver. Steam engines.
3271. W. E. Newton. Boring rocks. (A communication.)
35. H. D. Pochin. Manufacture of rosin, soap, or size.
189. C. G. Hall. Boots, shoes, and leggings.
425. J. Combe. Winding cops.
537. J. Tangye. Hydraulic lifting jacks.
544. P. D. Azemar. Winding watches.
555. J. Sim. Gas meters.
603. W. E. Newton. Reducing vegetable substances to pulp. (A communication.)
610. J. Revell. Rails.
617. T. H. Wood. Artificial fuel.
627. W. N. Wilkins. Manufacture of pigments.
650. H. H. Kromschroeder. Gas meters.
752. W. Tongue. Preparing, heckling, dressing, and combing fibrous materials.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated March 28, 1862.

2281. J. B. Howell.
2431. T. Smith.
2455. J. Davies and T. Evans.
2456. W. Maltby.
2458. R. A. Brooman.
2459. W. Thompson and T. Stather.
2462. C. G. Hill.
2464. W. T. Henley.
2470. T. Evans.
2473. W. Malam.
2477. C. Husson.
2478. A. David.
2487. J. Lansley.
2494. G. Nares.
2538. W. Clark.
2578. W. Clark.
2625. F. A. Calvert.
2638. F. G. Ward.

Sealed April 1, 1862.

2447. J. W. Scott.
2480. G. Knox.
2488. J. Edwards.
2490. W. Rowan.
2492. J. S. Collins.
2496. T. Hughes.
2502. G. K. Stothert.
2506. A. Ford.
2522. F. Curtis.
2523. W. Palmer.
2525. T. Tidmarsh.
2530. W. Mould, J. Hall, S. Cook, & W. H. Hacking.
2552. H. Nelson.
2604. J. H. Johnson.
2614. J. Bourne.
2616. C. De Bergue.
2636. G. England.
2643. G. H. Birkbeck.
2720. E. Leigh.
2732. J. A. Fanshawe and J. A. Jaques.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

765. M. Firth.
768. M. A. Muir and J. McIlwham.
778. T. Carr.
780. W. Mossman.
781. J. W. Kelly.
786. I. Spight.
787. T. Taylor.
798. C. P. Coles.
800. A. V. Newton.
806. T. Ivory.
809. S. S. Bateson.
836. J. Eccles.
851. L. Brierley and H. Geering.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

663. J. McKinnell.
664. J. H. Johnson.
709. W. Tytherleigh.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending March 29, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
1913	6	7	2051	0	3	2064	0	8	2077	0	3	2091	0	3	2104	0	10
2039	1	1	2052	0	3	2065	0	7	2078	1	3	2092	0	4	2105	0	3
2040	0	3	2053	0	3	2066	0	8	2079	0	9	2093	1	0	2106	0	3
2041	0	3	2054	0	3	2067	0	3	2081	0	3	2094	0	3	2107	0	6
2042	0	6	2055	0	3	2068	0	3	2082	0	3	2095	0	3	2108	0	7
2043	2	4	2056	0	9	2069	1	4	2083	0	4	2096	0	3	2109	0	7
2044	0	3	2057	0	3	2070	0	3	2084	0	5	2097	0	3	2110	0	3
2045	0	9	2058	0	4	2071	0	7	2085	0	3	2098	0	3	2111	0	3
2046	0	9	2059	0	4	2072	0	11	2086	0	7	2099	0	5	2112	0	3
2047	1	0	2060	0	3	2073	0	6	2087	0	3	2100	0	7	2113	0	7
2048	0	5	2061	0	9	2074	0	4	2088	0	9	2101	0	9	2114	0	4
2049	0	3	2062	0	3	2075	0	6	2089	0	7	2102	0	10	2115	0	10
2050	0	3	2063	0	9	2076	0	3	2090	0	3	2103	0	3	2116	0	10

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, April 3, 1862.

		£	s.	d.		£	s.	d.	nett
IRON:									
Rails in Wales and North of England	pr. ton	6	5	0	to	0	0	0	„
Welsh Bars, in Wales	„	6	5	0	„	5	7	0	„
Staf. Bars, at the Works	„	5	10	0	„	7	5	0	„
„ Hoops	„	7	10	0	„	0	0	0	„
„ Sheets, Singles	„	8	0	0	„	9	0	0	„
„ Nail Rods	„	6	15	0	„	0	10	0	„
„ Boiler Plates	„	0	0	0	„	8	10	0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	10	0	„	2	13	6	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	0	„
Scotch Bars	„	7	5	0	„	7	15	0	„
Swedish Bars, in London	„	10	10	0	„	11	0	0	„
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	96	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Australian	„	97	0	0	„	0	0	0	„
South American	„	0	0	0	„	0	0	0	„
Yellow Metal Sheathing	per lb.	0	0	9¼	„	0	0	0	2½
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	18	0	0	„	0	0	0	—
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	„
Foreign, Banca	„	6	4	0	„	0	0	0	nett
„ Straits	„	5	7	0	„	0	0	0	„
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	„	1	9	0	3
Coke, I.C.	„	1	1	0	„	1	4	0	„
LEAD:									
Pig, English	pr. ton	19	10	0	„	20	0	0	2½
„ Spanish	„	19	0	0	„	19	10	0	„
Common Sheet	„	21	10	0		22	0	0	„
Tea „ (Wimshurst's Patent] A special disct.	„	35	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	18	10	0	„	0	0	0	nett
For arrival	„	18	5	0	„	18	7	6	„
ZINC:									
English Sheet	„	26	0	0	„	0	0	0	1½
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	½

JAMES LAURIE, Metal Broker,
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 11, 1862.

ABRIDGMENTS OF THE SPECIFICATIONS RELATING TO SHIPBUILDING, REPAIRING, SHEATHING, LAUNCHING, &c.

We have again to thank the Patent Law Commissioners for the publication of a volume of the abridgments of specifications. This time the special benefit is conferred upon naval architects and shipbuilders, but it is impossible to estimate the influence for good which these publications have upon all parts of our mechanical and commercial systems.

According to the statute of monopolies passed in the 21st year of James I., for rendering null and void all monopolies, grants, and letters patent, for the sale, buying, selling, making, working, or using anything within the realm, those letters patent were excepted, under certain conditions, which related to the sole working or making of *new manufactures*.

Between that time and the end of 1860, up to which period these abridgments are brought, nearly one thousand royal grants were made of patent rights for improvements in the subjects embraced in this volume, viz., shipbuilding, repairing, sheathing, and launching, inclusive, it appears, of painting, lighting, ventilating, pumping, extinguishing fires, and preventing shipwreck, and other casualties; but not inclusive of anchors, cables, rigging, sails, and steering and navigating vessels.

The volume before us, which is published at seven shillings, gives a clear statement of every improvement mentioned in the specifications. It is, therefore, not only a ready index to all that has been done in this department of knowledge, but furnishes information almost as complete, with regard to the subjects of the patents, as is given by the printed specifications themselves. It must be observed, that the immediate tendency of the publication of these abridgments, will be to prevent that continual repatenting of the same invention, which has hitherto been so marked a feature in the history of patents. Every one familiar with these matters knows, that a very large proportion of the fancied novelties have been patented at least once before. The inventor has, however, in these volumes a ready means of discovering whether the ground has been previously occupied.

If, for example, he discovers an improvement in sheathing; by turning to the very clear and simple subject-matter index furnished with the volume, he will find the names of about sixty persons who have patented improvements in the *materials* for sheathing, and of twenty-four who have made improvements in the *modes* of sheathing. By referring to the pages indicated, he may travel over the whole field of invention in this department, and thus be able to form a correct estimate of the novelty, and perhaps also to a great extent, of the usefulness of his invention.

We observe that where, in some of the early patents, the reader might be led to suppose that he has discovered the first traces of a certain invention, but which invention is known historically to be old, the necessary information is given in a foot-note. We find, for example, with reference to this very subject of sheathing, that in connection with a patent for lead sheathing, granted in 1687, the following note is given:—

"It appears from a work on Architecture, "written by Leon-Battista Alberti in the "fifteenth century, that lead sheathing was "used in the second century. He informs us "that 'Trajan's ship' was weighed out of the "Lake of Riccia while he was compiling his "work, where it had lain sunk and neglected "for above 1,300 years. He observed that the "pine and cypress of it had lasted most remarkably. On the outside it was built with "double planks, daubed over with Greek "pitch, and caulked with linen rags; *and over* "*all there was lead sheathing fastened on with* "*little copper nails.*"

The introduction to the work makes no attempt to give a history of shipbuilding, but endeavours to enable the reader to form a correct idea of the state of the art, at the date of the earliest patented inventions. It concludes as follows:—"It "thus appears that at the commencement of "the seventeenth century, the art of shipbuilding had been cultivated with such success in England, that vessels of her Royal "Navy were not surpassed by those of any "other country; and that in their form and "general mode of construction, they were not "much inferior to the sailing ships of war of "the early part of the present century. Indeed, up to the close of the eighteenth century, "there had been nothing except the introduction of artillery to affect in any important "degree the practices which had prevailed for "ages. Up to that time ships were still built "of timbers and plank, and propelled by sails "and oars, as they had been for thousands of "years. But this century has witnessed a "marvellous change. It has seen the introduction both of a new material of construction and a new mode of propulsion. And "these have been attended with such success, "that the old modes are being rapidly displaced by the new, both in commerce and in "war.

"At this moment, while artillery, together "with the whole system of attack in naval "warfare, is undergoing change, it is easy to "foresee corresponding changes of equal magnitude in the system of defence; and we may "confidently expect that the next few years "will witness great and startling improvements "in the art of shipbuilding."

In an appendix we are furnished with a chronological list of important English and foreign works relating to shipbuilding, &c., beginning with Paul Hoste's *Théorie de la Construction des Vaisseaux, qui contient plusieurs Traitez de Mathématique sur des Matières Nouvelles et Curieuses*, published in 1697; and coming down to 1861.

It will thus be seen that no pains have been spared to make this work useful, and our best thanks are due to Mr. Woodcroft, for the great care and completeness with which the entire series of abridgments entrusted to his superintendence, have been hitherto prepared.

GOOD IRON, AND HOW TO GET IT

It is difficult to conceive, in this age of iron, a question of more importance than that which heads this article. Iron enters so largely into every branch of manufacture, that it may be said to have become a necessity, if not a necessary of life, and it is of vital moment, therefore, that manufacturers should understand thoroughly its nature, and know how and where to obtain it of the best quality. To these questions the anonymous author of a recently published pamphlet has, with some success, addressed himself. He starts by repeating a truism, which hourly experience further confirms, viz., "that by the penny-wise and improvident use of inferior qualities of iron, "much capital has of late years been wasted, "and much risk incurred." He might further have said that from the same cause many hundreds of valuable *lives* have been sacrificed, for have we not had most painful evidence of the fact in the disastrous wrecks of many iron ships, resulting entirely from their having been constructed of bad iron? We all know of the difficulties experienced by the Admiralty in obtaining iron of proper quality for shipbuilding, and of the quantity rejected altogether by dockyard officials, as unfit for use. The author of the pamphlet tells us, moreover, that "Great "Railway Companies have begun to make their "own rails because they despair of obtaining "them in any other way of the requisite quality." The prodigious development of the iron trade which the last half-century has witnessed has thus only "led us to a state of "confusion, in which good iron can neither "be bought nor sold." This is certainly a "dead lock," of the most disastrous kind, but it is to be hoped that there is a remedy for it as for most other evils, and that that remedy will be soon found.

Without following the writer of the *brochure* in question in his historical researches into the history and progress of the iron trade from the period when pit-coal smelting superseded so largely the charcoal process, we may at once come to the pith and marrow of the subject:—"What is good iron, and how is it to be got?" Printed official returns furnish the following facts in reference to the "make" of iron in Great Britain during the past twenty years:—

"In the year 1840, the production of iron in "Great Britain amounted to 1,396,000 tons. "In 1860, it had risen to 4,156,000 tons, and "to such an extent has the productive power of "the country increased, that to this last total "another million of tons might on any sudden "demand be added. It must also be noted "that great skill has been acquired in the art "of mixing irons, so as to give them the highest "quality of which they are susceptible. These "brilliant results are qualified, however," says our author, "by a fearful drawback. In the "year 1840, the cold blast iron produced "amounted, according to the returns, to "771,000 tons, or considerably more than "one half the whole make. In 1860, those "returns are totally and most significantly "silent as to the relative proportions of hot "and cold blast iron made in Great Britain. "Of the aggregate make of 4,156,000 tons of "1860 those best acquainted with the trade, "however, assert that there would not have "been produced more than the odd 156,000 "tons of cold blast iron. Truly, this is a "falling off indeed! and it justifies the assertion that while in twenty years the total "'make' of the country has been trebled, the "cold-blast make has dwindled down to one-"fifth of its former amount." These are startling facts in connection with the deterioration in the quality of iron, which appears to have more than kept pace with its increased rate of production.

There can be no question that competition and the extension of the contract system of transacting business have much to answer for as to the deterioration in the quality of iron. "Whole districts have for years past been "actively engaged in the struggle to make inferior iron supply the place of good." The large orders of Government for armour plates, and the great demand for iron for shipbuilding purposes generally, in both of which cases the very best material is required, ought to have given an impulse to the market, and incited a large production of the article in demand. Th does not appear to be the case as yet, and the best iron cannot be got for love or money.

It is something to have made the discovery that the cheapest kinds of iron are in the end the dearest, and it may be expected that the lesson will not be lost upon the ironmasters of the kingdom.

In regard to the "best" iron the writer of the pamphlet before us has some very just remarks to offer, and some of these we shall not hesitate partially to transcribe:—

"So many are the uses of iron, that no iron is the best in the sense of being the best for all purposes; but, in common parlance, 'best,' generally, denotes the first-class iron, the grey cold blast, including all its denominations applicable to different uses, and bearing different prices. 'Best,' used with reference to a special purpose, means that denomination of iron most suited to that purpose. * * * For the present purposes of the Government it will be universally admitted that none but the best iron can safely be used."

After some practical information as to the modes of treating pig iron, the mixture of various kinds of it, and the hardness or toughness resulting from such treatment and mixtures, the pamphlet writer comes to the important subject of testing iron for various purposes, and to the point, "how is the best iron to be got?" In a second article we shall revert to this question, but, in the meantime, we recommend the pamphlet, published by Murray, of Albemarle-street, to the notice of "all whom it may concern."

INVULNERABLE FLOATING BATTERIES.

We refer with much satisfaction to the report, in another part of this day's impression, of the interesting and remarkable experiments which took place on Tuesday last at Shoeburyness. The manner in which they were conducted reflects great credit on Government, and shews they are acting in the right direction, with energy and decision.

We are strongly impressed with the soundness of the opinion expressed in our last number as to the necessity of an experimental Iron Armour Commission, with ample powers to act on its own responsibility, and having funds at its disposal for a prompt and fair trial of plans of armour plating. Without any breach of confidence, we may add, from private communications with which we have been favoured, that the same idea is entertained in influential quarters, where it is felt that some guarantee must be afforded to the public that the national energy and resources shall not be expended in vain, in carrying out the schemes of contractors who have access to official channels, whilst well-digested plans, not favoured with official support, cannot obtain the chance even of a trial.

If Government are in earnest, which we cannot doubt they now are, they will not object to the immediate constitution of an effective working body of practical men, who should devote their whole time to the business entrusted to their management. Actual experiment on a liberal scale is the only means of ascertaining the best modes of applying this new system of naval defence. Evidently, it would be better to make too many trials than too few. The cost of any number of experiments under such a control would be trivial, compared to the money that might be wasted in the experimental armour-plating of a single vessel. Take, for instance, the four ships already launched. The tongueing and grooving of the edges of the plates, which is now acknowledged to be a serious defect and source of weakess, caused an extra expense of £10,000 to £12,000 for each ship. The inefficiency of this plan might have been discovered by previous experiments at an outlay of £1,000. But the loss of these large sums is not all—by the mechanical blunder made, the efficiency of the armour, and consequently the defensive force of those vessels is seriously impaired. There is reason to believe that the use of enormous plates, such as those attached to the four ships afloat, and ordered for five or six more, is a fatal mistake. What we learn of the modes of armour-plating the Monitor and the Merrimac appear to corroborate that opinion, small plates and even railway bars having been used for those ships. We lately published calculations showing the immense difference of price between large and small plates, amounting to £30,000, or £40,000, for a ship of the Warrior class. But what is still more important, by using smaller plates, floating batteries, can be built in a much shorter time. The Duke of Somerset stated that the difficulty of manufacturing large plates was the chief cause of delay in the construction of iron-cased ships.

To settle these points and many others, and determine which is the most perfect system, experiments must be made at some considerable cost, and this should be done promptly, so that Government may not be hurried precipitately into building or armour plating batches of floating batteries and men of war on erroneous principles. Whilst the frames of batteries are being set up, a series of experiments, conducted with energy and a proper organization, might determine the questions of fastenings, backing, and size of plates, so that no time might be lost.

We have good authority for stating that a motion for the formation of an experimental Committee will be made in the House of Commons immediately after the recess. Much will depend, however, upon the nature of the long-expected Report of the Special Committee on Iron, of which the publication is anxiously expected.

We are the more desirous to fix public attention on the one important object of testing plans *before* they are adopted, because Government, if we may regard the *Times* as its organ, is determined not to give up the forts at Spithead. A letter in that journal, signed "Pioneer," taking up the idea of the possibility of guns of enormous power, capable of discharging shot of 1,000 lbs., argues that those forts are necessary to oppose armour-plated ships, which the writer says "might take up a position most favourable for shelling Portsmouth or any other dockyard, utterly regardless of the storm of shot fired at them from the ironsides or cupola ships stationed for the defence of the port." A fallacy of argument runs through this supposition, which a little explanation will demolish. In the first place, the ironsides of an enemy coming to attack our harbours must be a sea-going ship. She cannot, consequently, with sea-going qualities, be constructed on the same principles of solidity and strength, and carry armour or be armed with guns of the same weight as floating batteries, constructed expressly for the defence of harbours. Therefore, the latter could carry a much heavier armament. As to the monster guns, which, it is assumed, can be constructed, all the experience we have had tends to prove that the strength of iron will not resist the tremendous explosion of the heavy charges they require. A list has been lately published in our columns of a great number of guns of that description which burst at the first or after a few discharges, amongst them was the gun on board the United States man of war, Princeton, which killed the American Secretary for War and several other persons who were standing by when it was fired the first time. But, admitting the possibility of producing guns of that description, there is no reason why they should not form part of the armament of a floating battery as well as a fort. This being the case, the advantage in favour of the former arrangement will be immense, because an invulnerable floating battery, armed with monster ordnance, could go alongside or approach within short range of the enemy's iron-clad ship, and plant its irresistible missiles with far greater effect than stationary forts could at long ranges. This being so, really disposes of the question, and leaves no argument in favour of building forts. By all means let us not waste a shilling in useless defences, but apply all our resources to the construction of floating batteries. There will be time enough to erect forts when the imaginary great guns are made and found to be serviceable.

If any additional arguments were wanting to prove the absolute necessity for decisive experiments on a large scale before we cover more ships with armour plates on the plan of the Warrior, or before we adopt new modes of armour plating, we think the most convincing arguments will be found in the details of cause and effect contained in our report of last Tuesday's experiments.

THE BATTLE OF THE TARGETS AT SHOEBURYNESS.

[FROM OUR SPECIAL REPORTER.]

Tuesday was a grand field day at Shoeburyness The annihilation of two first-class wooden men-of-war, of the United States navy, by an armour-plated ship, has agitated society in this country from the lowest to the highest rank. We are suddenly awakened to the consciousness that we no longer possess a navy, and royalty even is aroused. A numerous and distinguished assemblage, including H.R.H. the Duke of Cambridge, the Duke of Sutherland, the Duke of Somerset, and other Lords of the Admiralty, a large number of naval and military officers and high officials, Sir John Hay, M.P., and Mr. W. Fairbairn, with their colleagues of the Iron Plate Committee, several eminent shipbuilders, engineers, and gentlemen interested in the great question of the day, including Sir William Armstrong, were on the ground as spectators of a trial of strength between the Warrior and Fairbairn targets, as well as of experiments with the new Armstrong shunt gun. So intense was the interest excited by this remarkable contest that fancy might picture the sensation as something akin to that experienced by the crowds who gazed on the fight between the Monitor and the Merrimac, on the banks of the James river and Hampton Roads.

On a late occasion we recorded the damage suffered by Mr. Fairbairn's target, from the screw bolts with which the plates were fastened breaking off at the nuts, inside the skin, from the effect of vibration. To render the description which follows clear, we will remind our readers that this target consists of armour plates in close contiguity with the plates representing the skin of a ship, without any backing, whilst the Warrior target, which is a fac-simile section of the Warrier herself, is provided with 18 inches of teak between the armour plates and the skin. Since this last trial, when the former target had to draw off like the Merrimac for repairs, the broken bolts were replaced by others more securely fastened, some by means of screws and nuts, others, by riveting and counter-sinking the bolts at both ends. The nuts were screwed up against washers of iron and various soft or elastic materials, as wood, india-rubber, and spun yarn, and thin sheets of india-rubber or felt were interposed between the armour plates and the skin, the object of these arrangements being to prevent the vibration which had been so disastrous at the last trial. Not to disturb our narrative, it may here be mentioned that the india-rubber and felt packing between the iron surfaces answered their purpose, as the screw and rivet bolts stood admirably the most tremendous shocks, but the insertion of yielding material between the nuts and the skin turned out to be a mistake, the bolts which broke being some of those so provided, but of the other bolts and counter-sunk rivets not one was broken.

The Fairbairn target, thus refitted, we may say figuratively, came out of port, and challenged the Warrior section, which may be supposed, looked on contemptuously, proud of her former victory—at all events, her constructors did. The two targets stand side by side, are of the same dimensions, 20 feet by 10 feet, and with the difference before mentioned, similar in construction. As regards the backing to the armour plates, it was a contest between iron and wood. For five hours, like the American iron-sides, these targets encountered a continuous battery of projectiles. The Warrior having in her trial in October received a large amount of punishment, was on this occasion fired at only by solid shot, weight 156 lbs., with the Armstrong with successive charges of 40 and 50 lbs. of gunpowder. The Fairbairn was hammered at incessantly with rounds of shell, and 68-pounder round shot from smooth bores, and 110 and 140-pounder solid shot from Armstrongs, the last from a shunt gun. We will not attempt to give a detailed account of this remarkable feat of arms, in which the antagonist forces suffered heavy damage, and were both so much disabled as to be rendered *hors de combat*. The technical details would occupy too much time, and not be so interesting or instructive to the public as a description of the most noticeable features and general results.

The Warrior was attacked by the Armstrong guns intended, when rifled, to fire 300-lb. bolts, but now, being a smooth bore, firing 150-lbs. round shot, four of which formidable missiles were hurled against the representative of the noble ship, two with 40-lb., two with 50-lb. charges, each shot separately. No description can give an adequate conception of the destructive power of these iron globes, propelled with such heavy charges of powder. At a range of 200 yards they rushed from the cannon's mouth against four different points of the target, and with wonderful precision struck the points aimed at, and sweeping destruction followed each impact. The armour plates, 4½ inches thick, were smashed or pierced through and through. The shot with the smaller charges (40 lb.) split and crushed the iron over a surface of 3 or 4 square feet, and caused deep cracks, 18 inches to 3 feet in length, the teak backing being splintered into match-wood. The 50-lb. charges carried the two projectiles unresistibly through the armour plate and 18 inches of teak, and bursting through the ship's skin and iron ribs, one which struck a bottom plate buried itself in the thick balks of timber which form the foundation of the target, and may be considered as the gun deck, the other, which struck the upper part of a top plate, made a monstrous ragged hole through the thick iron and teak, and hurtled away through the air out to sea as if rejoicing at the havoc it had done. Evidently, if the Warrior in action had been penetrated by these four shots, unless she had inflicted equal damage on her adversary, must have struck her colours. She received one wound between wind and water of so lacerated and ugly a character—which a bystander appropriately termed a compound fracture, smashing skin and bone and muscle and sinew—that the healing of that wound under fire would have been impossible. The others were so far fatal that they opened windows in the armour plates through which those formidable explosive shells which made the decks of the Cumberland and Congress charnel houses, could be poured into the ship by the enemy.

So much for the boasted prowess of the Warrior. But do we from this catastrophe conclude that iron armour cannot be made invulnerable? Far from it. A reference to our report of the first trial of this target will show that from the defective construction of the armour plates its speedy destruction might be anticipated.

We are sorry to report that the rival mailed structure, the child of the Iron Plate Committee, fared no better or rather worse than the Warrior section. At the close of the day, after suffering the assault of ten distinct rounds, including forty-nine heavy projectiles of every kind before-mentioned, except the terrible 150 lb. Armstrong solid round shot, the Fairbairn was left in so miserably maimed and crippled a condition, that had she been a vessel engaged in deadly strife with artillery she must have been in a sinking condition. But the Iron Committee gallantly fought their ship to the last, determined to ascertain her defensive properties with the view of determining the weak as well as the strong points of the system of armour plating which this specimen illustrates.

In an experimental point of view too much praise cannot be given to the members of the Special Committee for the energy, perseverance, and intelligence they displayed in conducting the day's proceedings. In spite of wretched weather, and trampling in mud and slush, they were engaged in their useful labours from 10 to past 5 o'clock; Mr. Fairbairn, who took the command, being most active and persevering up to the last moment, continually urging the artillery to new trials of strength in this remarkable combat.

The Lords of the Admiralty, as well as the Duke of Cambridge, evinced a laudable anxiety in watching and examining the effects produced. At the sound of "cease firing," they took the lead in the throng which rushed from the cover of casemates, and observed attentively the effect of every shot. Many of them were seen mounting by a ladder to a giddy height on the timber which represented the upper deck of the Warrior, to scrutinise the extent of internal damage caused by that destroying missile which fled away seawards, leaving a round hole bigger than a man's head. We will not vouch for the Royal Duke having gone aloft, but certainly the Duke of Somerset was at the post of danger.

These experimental trials have been most instructive, and in that sense successful. They were carried out in the way so strongly urged by the MECHANICS' MAGAZINE. The targets were attacked *à outrance*, and the results were invaluable. Many minor points are decisively settled. It would be an elaborate work not suited to a hebdomidal survey of scientific and mechanical events, to enter into a minute analysis of the practical results of this really effective artillery practice on iron armour-plated structures, but we will briefly describe the facts which seem to be definitely determined.

1st. The little dependence to be placed on through bolts, or any kind of fastening exposed at the surface to the impact of projectiles; indeed, we may say, their self-destroying character was clearly proved. Five or six of the bolts, of which the heads were struck by shot, were instantaneously converted into powerful wedges, which taking up the momentum were driven through the 4½ inch plate, and split the iron asunder. One bolt, after performing this destructive exploit most effectively, by literally dividing a massive-plate into two parts, escaped through the target, whizzing away to sea.

2. Bolt holes were positively proved to be a source of weakness, for in a dozen places long and deep cracks were caused in zig-zag lines from one hole to another. It was in fact demonstrated that the through bolts and their holes greatly aggravated the damaging effects of the artillery fire, which unquestionably would have been less destructive if more secure modes of fastening had been adopted.

3. Wood as a backing is utterly condemned; whatever its advantage to prevent vibration and protect the ship's skin, it undoubtedly facilitates the demolition of the plates and the rupture of the fastenings. This is the case of the Warrior, and applies to the wooden ships intended to be armour-plated.

4. The arrangement of armour-plates close to the skin of an iron ship without an intermediate backing is exemplified by the Fairbairn target to be wrong in principle.

We will make no further commentary, leaving facts to speak for themselves.

The performances of the day were brought to a close by a little interlude, both interesting and instructive. A system of backing plates with plaited iron wire and wood on the plan of an inventor, whose name we did not learn, was submitted to trial by the Iron Plate Committee. Four small targets, ingeniously constructed for comparative trials, were fired upon with a 6-lb. conical ball from a small piece with the same charge. Each target was of the same dimensions, and contained the same weight of materials. No. 1 was all iron; No. 2 and 3, iron and plaited wire of different thickness; and No. 4, iron, wood, and wire in layers one over the other, the iron in every case outside. No. 1 repelled the shot, receiving only a slight indentation; No. 2 and 3 were penetrated through the iron plate, and nearly through the wire backing; and No. 4 was pierced through and through, showing conclusively the total inefficiency of wood or any yielding substance as a backing.

Another system of armour plating, the invention of Captain Inglis, of the Royal Engineers was to have been experimented upon; but no time was left for the trial of his plan, which consists of wrought-iron planks crossing each other in alternate layers, and secured by screw bolts. We understand this trial will come off in a few days. We also observed that active preparations are in progress on the ground for the erection of Mr. Scott Russell's and Mr. Samuda's targets, which are in a forward state, and will be subjected to the searching test of artillery as soon as possible.

SPEED OF TRANSMISSION IN LONG TELEGRAPH CABLES.

The phenomena which in submarine cables of any considerable length are formed in the present state of science to retard the speed of transmitting signals through them, though presenting no great difficulty of comprehension, would, if we may judge by the manner in which they are written about when occasion brings them forward, in a popular form, or as the battle ground of rival lines of telegraph, appear to be either very imperfectly understood, or very unfairly handled.

We allude more immediately at this time to the treatment this subject received last week in an article in the *Times* on the rival merits of the two companies now proposing to establish telegraphic communication between Europe and America. In that article it is attempted to be shown that "nine times the speed of transmission can be obtained from a line of 500 miles that would result from working a line of 1,500 miles in length," and, by consequence, that inasmuch as the line between Ireland and Newfoundland, requiring 1,900 miles of cable will, according to the highest authorities, be enabled to work off messages at the rate of eight to ten words per minute, *therefore*, the northern route by Greenland and Labrador, with two sections requiring considerably over 300 miles of cable each, and two others, requiring respectively 720 and 960 miles, in all about 2,300 knots of cable, will be able to work at nine times that speed (or at the rate of seventy-two to ninety words per minute).

In order to set up this absurd proposition, the law laid down by Professor Thomson and others, is seized by the adverse writer, and isolated from its companion truths, in which it is shown that "the difficulty of working through long circuits, owing to the retarding effects of inductive electricity, increases in about the square of the length of the line when long insulated wires are laid either in the earth or under water."

Now this law in the abstract, and separated from the surrounding circumstances incident to the practical construction of a long cable, is admitted to be a fundamental truth—but it is a *guide* and not an *obstruction* to the construction of long telegraphic circuits, and has led to the discovery of other truths by Professor Thomson, Mr. Varley, Mr. Jenkin, and others, which have reduced to an almost absolute certainty the results to be expected as regards the rate of speed in submarine cables. These laws have been well expounded by those electricians in practice, and described in various publications, particularly in the evidence and appendix attached to the Government report on telegraphic cables.

Three elements are concerned in producing the retardation of telegraphic signals, the copper conductor, the insulating sheath, and the earth.

The copper conductor, if constant throughout its whole length, possesses a power of conducting the electric force in simple proportion to its thickness, and in inverse proportion to its length.

This conductor, when surrounded by a substance of a comparatively non-conducting or insulating quality like gutta-percha, becomes a leyden jar; and in this state Professor Thomson has shown that the capacity of the copper for receiving what is called the charge, or in other words, its electro-state capacity, by which the rate of signalling is effected, depends on the *ratio* of the diameter of the gutta-percha, to the *ratio* of the diameter of the copper, being at the same time independent of the *absolute* diameter of either.

This electro-static or retarding influence, however, only manifests itself while the insulating sheath of the conductor is in contact with the earth, shewing that the loss of speed in transmission arises simply from the increased induction derived from that contact, owing to the inductive capacity possessed in a superior degree by gutta-percha over the same capacity in air, which is the surrounding medium of the conductor in the case of land telegraphs. This is shewn by the fact that if a copper wire insulated along its whole length with gutta-percha, be suspended in the air, it will be found to have lost nearly all its inductive tendency, which, however, will be rapidly restored to it when laid again in earth or immersed in water.

This, then, being the state of facts as regards the conducting power of the copper, the inductive capacity of the insulator, and the influence of contact with earth or water, it is manifest that the rate of charging and discharging a cable—which is the main circumstance affecting its speed of transmitting messages—must depend, first, upon the size of the conductor, by which is determined the quantity of electric force that can be thrown into the line with advantage at one blow; and, second, to the ratio of insulation applicable to the diameter of that conductor, so as to reduce to a minimum the influence of inductive absorption.

It will thus be apparent that whatever the length of cable required to be laid, the speed at which it shall work may be determined to a nicety; indeed, the whole thing has been tabulated in a most convenient form by Mr. Varley, shewing from practical results the capacities of gutta-percha for inductive absorption from one to 350 layers, and it is clear that within comparatively reasonable limits, as to expense of materials, the induction may be decreased and the speed increased to any useful extent.

It is true that by increasing the circumference of the copper wire, the surface for inductive action is increased also; but inasmuch as the induction is merely superficial, and increases only as the circumference of the copper, while the conducting power of the latter increases as the square of its diameter, it is manifest that the gain to conduction goes on increasing with the size of the copper in an enormous ratio, and as stated by Mr. Varley, "if the wire so increased in size be coated with insulating material to such a thickness as shall give the same induction as the former or smaller wire, the result will be that four times the speed will be obtained."

Nor must it be supposed that in order to attain a comparatively high speed along a cable 2,000 miles in length, it would be necessary to increase the quantity of material and consequent expense beyond what would be equally desirable and economical in a line divided into sections, varying from 300 to 900 miles each. The quantity of copper and gutta-percha employed in making the core of the cable, now suggested by Glass, Elliot & Co. to the directors of the Atlantic Telegraph Company, to be laid between Ireland and Newfoundland, is to be 510 pounds of the former to 550 pounds of the latter. This cable has been certified by electricians whose opinions are unquestionable, to be capable of working at the rate of eight to twelve words per minute. If we take the mean at ten words, and refer to Mr. Varley's evidence before the Board of Trade Committee, we shall find that if the Atlantic cable can be made to speak at that rate, it will not, in speed at least, be very far behind even the land telegraphs of this country. Mr. Varley, who is at the head of the Electrical and Engineering Department of the Electric and International Telegraph Co., says, respecting the working of land lines:—"In practice, we seldom work on the English lines at a higher rate than twenty-two words per minute. An entire hour's work will seldom shew a higher speed than twelve or fifteen words per minute."

If this be so, and if the direct Atlantic Telegraph line be able to work at 8 words per minute, how is it possible that a line of upwards of 3,000 miles in length, from London to the confines of Labrador, working in four sea sections, whose lengths of cable are respectively 270, 360, 720, and 960 miles, with the retardation due to these sections, and the impossibility of using relays, at all events, on the longer sections, can transmit messages at the rate of nine times faster, or, indeed, any faster than the direct Ireland to Newfoundland cable. The fact is, that a very large staff would have to be kept at the terminus of each section, and every message would at each terminus have to be read off, and re-transmitted to the terminus of the next section, and thus every message and signal would have to be repeated eight or nine times at least during its transit from London to New York, and the result would be that, with all its apparent advantages of short circuits, it is very problematical whether intelligence could be sent to America by the northern route even at as good a speed as by the direct Atlantic cable properly constructed and laid.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER. VII.

The Monitor and the Merrimac will live in history. What a revolution they have made. Their iron blows have reverberated across the Atlantic, and aroused England to a sense of real danger. Never was there such unanimity. Both houses of Parliament, the ins and the outs, the press and the people, and even Government at last join in one cry, "Build armour-plated men of war and floating batteries." The Premier and the First Lord of the Admiralty have had the good sense to yield to the rising storm. The Minister for War and the Secretary of the Admiralty have eaten their leek. May the omen be good; let us hope the Admiralty will mend its ways. Certainly it has received a rude shock, and the believers in wood in the controller's department will find their occupation gone. The shipbuilding craft will change its nature. Naval architects will lose much of their prestige. Engineers will design men of war, and the naval constructive art will perhaps become more of an exact science than it hitherto has been. Only think of the Merrimac being in three months converted by rebel engineers into a rude machine, which in a few hours annihilated the finest structures of the United States navy, and then the little Monitor, created by a Swedish engineer, disabled the machine which had done its work so bravely. Verily shipbuilding as applied to men of war is revolutionized. The late inroad of the civil engineers into the domain of the naval architects, which provoked a rather piquant controversy, has foreshadowed the approaching amalgamation of the two professions. We are on the eve of great changes in the structure of war ships; we shall hear less of displacement and flotation, and wave and load lines, and profound calculations for regulating speed and tonnage; and learn more of practical plans for constructing invulnerable floating bodies for attack and defence by the application of engineering science and mechanical skill. It was well said by an eminent engineer that "naval architecture to be regarded as a science should give exact results from exact calculations." But is that the case? By no means; for naval architects as a rule are always at variance with each other, and continually propounding incomprehensible theories. And as to practical results, it is notorious that the best lines of the finest ships in the British navy are copies from the French. These remarks may be thought by some irrelevant to the subject of "iron walls," but they are not; England wants invulnerable fighting ships; they are the conditions of her existence; and at any cost she must have them. The Admiralty have tried their hand, they have lavished millions, and their naval architects have produced a Warrior, which is neither a good sailing nor a good war ship. She is a compromise, and proves that the constructive department of the navy are not equal to their task. The fighting qualities of the noble ship have been sacrificed to the attainment of speed. The main object of her creation has been abandoned, she is left vulnerable in her vital parts; the portions of the armour plates intended to protect her bow and stern being placed midships, because the architect miscalculated the effect of their weight at the extremities of the ship.

At the sudden discovery of a terrible and impending danger, we are consoled by the assurance that we have *two* iron-cased men-of-war afloat capable of coping with an enemy. But let not the nation be deluded. That statement is not true; nor will it apply to any of the other three or four additional iron-clad ships we are led to hope will be ready for sea by the end of the year.

Reverting to the information I have published on the subject of fastenings and backing of plates, and to which I entreat our legislature, if they wish to save their country from a great calamity, to turn their earnest attention, I do not hesitate to declare that there is no safety for England in "Iron Walls" constructed on the plan of the Warrior. Large plates fastened with through bolts on a wood backing will not stand the concentrated fire of a few broadsides of heavy guns. The plates struck will be detached from the ship bodily. This is not a question of the penetration of iron plates by projectiles, but of the fastenings being destroyed by impact. Any competent engineer who takes a survey of the Warrior target at Shoeburyness, when he sees the damage done to one plate by five or six shots, of which only two were 68-pounders, will be satisfied that one or two broadsides of the same force, on the same plate, would knock it off from the ship.* From that moment the invulnerability of the Warrior would cease. The removal of one of her plates, fifteen feet by three feet, would open an aperture in her armour through which missiles would be poured in between her decks, and the Warrior would be as helpless as a wooden ship. The incendiary and explosive shells which cannot penetrate armour plates, would crush through the teak backing and half-inch iron skin, setting the wood in flames. Through that one opening she would be destroyed by an antagonist of much smaller size, if protected with armour plates effectually secured.

I have been diverted from continuing the description of proposed modes of armour plating by the event in America, which excited so much interest in this country, and is a practical illustration of my views, acting on public opinion more forcibly than any observations I can offer. The impenetrability of the Merrimac to the projectiles fired from the Federal men of-war and batteries, and the negative effects of the fire of the two iron-clad vessels on iron plates are instructive lessons, but they require careful consideration before any conclusions can be drawn from them. In the newspapers so many erroneous and contradictory statements have appeared on this subject, I will venture to offer some observations for the purpose of placing it in the right point of view. The accounts we read of the missiles from the Congress and Cumberland, and from the forts, glancing off the plates of the Merrimac like hail, and the small amount of damage inflicted by the mailed batteries upon each other, prove that armour-plated ships will destroy wooden men-of-war, and may with impunity come within range of land forts, but they prove nothing as to the invulnerability of iron armour, or of the two American ironsides. The simple explanation of the small damage they sustained, is, that the projectiles with which they were assailed were not of sufficient force to penetrate the armour. The Dahlgren, Parrot, and other American guns of large calibre, are loaded with small charges and fire shells or heavy shot, at low velocities, which our own experiments have proved are perfectly innocuous against iron armour plates exceeding four or five inches in thickness, and consequently could do no injury to the armour of the Monitor or Merrimac, which is described to be seven and eight inches, and in the most exposed parts eleven inches in thickness. There is, however, little doubt that both these vessels might be seriously damaged, if not destroyed, by the fire of 68-pounders and heavier smooth bore guns.

Perfect invulnerability may not be attainable; but that is not the question. The great truth is revealed, that we must have a mail-clad navy; and if we cannot make our ships invulnerable, we must adopt the most efficient modes of constructing iron armour which can be invented.

The experiments at Shoeburyness on Tuesday last have thrown a new light on this all-important subject, and spread dismay in official quarters. The system of armour plating so hastily and confidently adopted for the Warrior, and all the other ships built or contracted for, is proved to be a complete failure. The *Times*, in its report of Tuesday's experiments, continuing the same system of misrepresentation which I before commented upon, refers to the trial of the Warrior target on the 21st October as if it had been a fair test of its powers of resistance to the missiles then discharged against it, and a complete success. In a former letter, I showed that the amount of punishment then inflicted was insignificant, and that, nevertheless, the damage was so extensive as to prove that even with 68-pounders from smooth bore guns, the Warrior might be destroyed. The effect of the heavier Armstrong smooth bore guns has so hopelessly dissipated the illusion of the Warrior's invulnerability, that public attention is attempted to be diverted from that disclosure by attributing the terrible damage to the target entirely to the increased force of the 150 lb. shot. But the real cause of the disastrous result of Tuesday's trial is the wood backing, in the form of 18 inches of teak between the armour plates and the skin. It has been stated in my letters, and at this momentous crisis, it cannot be too often reiterated, that no iron plate, even of 8 inches, much less of 4½ inches in thickness, can resist a 68-pounder with a 16 lb. charge. How, then, can the 4½ inch plates of the Warrior bear the shock of 156 lb. solid round shot with a 40 lb. or 50 lb. charge.

These last experiments leave the question of armour plating where it was with reference to the best modes of construction, with this exception, that they prove more incontestably than before that wood backing and through-bolt fastenings are mistakes, and must be given up. But the right modes of backing and fastening still remain to be discovered, and it is now impossible to leave those questions any longer in doubt.

A Civilian.

The American papers deny that there were any Armstrong guns on board the Merrimac during her engagement with the Cumberland and the Monitor.

Telegraphic Intelligence.

TELEGRAPH TO INDIA COMPANY.

Recent advices from Suez state that in addition to the success of the company in securing communication with Jubal, an arrangement has been effected with the Egyptian Government, through the influence of Mr. Latimer Clark, of the firm of Sir Charles Bright and Clark, who has the work in charge, whereby the Government of Egypt undertake to give up to the Telegraph to India Company, not only the revenue proper derived from their sea line, but also the receipts of the land line between Alexandria and Suez. These latter receipts, even during the first week of opening, were alone at the rate of £2,000 per annum. It is thought that the chances of repairing the Aden and Kurrachee length, which is now being proceeded with, are very promising if the season of good weather continues to its full length, though the time intervening between the present and the end of the usual term of that season is considered much shorter than is desirable, with a view to the devotion of great care to the work.

The old Red Sea cable is said to be capable of being lifted with tolerable ease in the shallow water, notwithstanding that the external iron armour having had no surrounding protection to keep it from oxydation is in many places entirely rusted asunder. The gutta-percha core, however, is in every instance found to be as good as ever as regards the quality of the gutta-percha.

Mr. Clark has, however, found already several instances of the action of local heat upon the cable to an extent which could scarcely be credited, and which, in his opinion, is abundantly sufficient to have accounted for the destruction of the communication, but he cannot at present judge whether this will be confined to the Jubal portion only, or whether it is general. The heat probably has been communicated either by submarine volcanic action, such as is so common at the Azores and on the western coast of Iceland, or it will be due to the presence of boiling springs at the bottom of the Red Sea. At all events the circumstance shows the necessity for the fullest and most accurate preliminary soundings and examination of the bottom in all waters wherein cables are to be deposited, especially in all where the suspicion of pointed rocks and organic submarine disturbance is so natural as in the Red Sea.

DINNER TO MR. R. A. GLASS.

On Friday last the friends of Mr. R. A. Glass (of the firm of Glass, Elliot, and Co.) invited that gentleman to dinner at Grillion's Hotel, Albemarle-street, to congratulate him on his return from the East after an absence of six months, during which time he has superintended the bringing into successful operation of the Malta and Alexandria and other cables, which are among the most important events hitherto achieved in ocean telegraphy. Upwards of forty gentlemen sat down to dinner under the presidency of the Honble. Mr. Grimston, Chairman of the Electric Telegraph Company.

Among the gentlemen present were Lord Otho Fitzgerald, the Right Hon. James Stuart Wortley, Mr. Mark Philips, M.P., Mr. Bidder, C.E., Sir Charles Bright, Mr. Critchley, Captain Galton, R.E., Mr. Joseph Whitworth, C.E., General Wylde, C.B., Mr. Crampton, C.E., Mr. H. W. Woodhouse, C.E., Mr. H. Ford Barclay, Mr. W. H. Smith, Mr. Varley, Mr. N. Walker, F.R.S., Mr. Chatterton, Mr. Fourdrinier, Mr. George Saward, Mr. Edward B. Bright, &c., &c. After the toast of the evening, the success of the Atlantic telegraph enterprise was proposed, and was responded to in an eloquent speech by Mr. Stuart Wortley, the chairman of the original company.

In addition to the various working models of marine engines which Messrs. Maudslay and Field intend contributing to the Exhibition they purpose sending the pair of 400 H.P. direct acting engines which they have prepared for the iron-plated screw-frigate Valiant, the sister ship to the Defence. Messrs. Rennie also purpose sending several models of marine steam-engines, as well as a model of their celebrated iron floating docks. Messrs. David Napier and Sons, of Lambeth, will make a considerable display of models and machines, and in printing and bul-making machines especially they will, it is expe be abundantly represented.

---

* This refers to the first trial of the target in October, and was written before the trial of Tuesday last.

balls as heavy, and the revolution as rapid as is required, any desired amount of force may be obtained in this governor, which is so constructed that its action is nearly frictionless.

Increase in the velocity of revolution within reasonable limits is preferable to increase of weight in the balls, centrifugal force increasing in the same circle as the square of the velocity, but only directly as the weight of the revolving body. Since centrifugal force varies as the *square* of the velocity, while momentum varies only *directly* as the velocity, the power required to run this governor, and the difficulty of maintaining a positive motion by means of a belt are small compared with a governor in which changes of momentum furnish the force for working the valve.

Where a fly throttle valve is employed a comparatively moderate power in the governor, and consequently lighter balls, and less velocity, will be sufficient even for the largest engines, and the pressure on the governor centres causing the principal strains upon the driving belt will be avoided. Throttle valves can be made free from any liability to be jammed in the chamber, and closing sufficiently tight to regulate perfectly even the largest condensing engines.

The cone pulleys and belt shifter enable the engines to be regulated at any speed from forty to fifty turns per minute, which the engineer may desire.

This governor is accurately balanced and revolves as easily as a little wheel of the same weight and size; the moderately high speed employed, from 300 to 400 revolutions per minute is therefore not at all objectionable.

For further information concerning this invention, we refer our readers to the sole agents for the United Kingdom, Messrs. Charles B. King and Co., 20 Abingdon-street, Westminster.

THE GREAT EXHIBITION BUILDINGS.

By William Fairbairn, LL.D., F.R.S., etc., *President of the British Association for the Advancement of Science, etc.*[*]

(*Concluded from page* 234)

In the designs for the galleries great care was taken in regard to light and ventilation, so essential to the inspection and preservation of pictures. On ascending the stairs, the visitor enters a vestibule of the same proportions as the hall below, and from this point is obtained an unbroken vista through the whole extent of the gallery; and it is difficult to conceive a more imposing effect than the noble proportions of the galleries on both sides.

An eminent writer, in describing it, states that—

"On entering the front, on either side the visitor will find himself in a spacious hall, 325 feet long, 50 feet wide, and 43 feet high. Passing through this, he will enter one of the wing towers, which forms a room 52 by 45 feet, and 66 feet high; he will then enter another room, 75 feet long, and of the same width and height as the first, from which he will pass into the end tower, where he will have an uninterrupted view of the whole main gallery. The interior decoration of these rooms is very simple, and may be briefly described as a plain cove extending to each side of the skylight, and resting on a moulded cornice."

Thorough ventilation is amply provided by the admission of air through apertures at the level of the floor, and allowing the vitiated air to escape through louvres[*] in the skylights above. The lighting of the gallery is very successful, and the important point gained is an equal distribution of light, so as to prevent any reflection of rays from the picture to the eyes of the spectator. This has been successfully accomplished, and there is every reason to believe that in any position where the spectator may stand, the pictures will be seen with the best possible effect.

The galleries, which extend along both sides of the nave and transept, are supported by cast-iron girders, which rest on the double columns, which ascend to a height of fifty feet from the floor, and from which spring the principal arches of both nave and transept. These girders are at right angles with the line of the nave and transepts, and rest on single columns twenty-five feet high under the centre of the fifty feet wide galleries, and on those which surround the spacious courts on both sides of the nave. They are formed of a series of equilateral triangles, which unite the lower and upper flanges, and are calculated to support more than four times the load that ever can be brought upon them by a crowd of people closely packed. Between the transverse cast-iron girders the joists and flooring are supported by wooden beams trussed with iron rods; and on these and the front iron beams (to which is attached handsome railing on both sides surrounding the nave and courts), are placed the joists and boarding, forming an extent of upper gallery accommodation equal to *one mile and a half in length*, and varying from fifty to twenty-five feet wide.

The upper girders which support the flat roof, covered with felt and zinc, are of lighter construction than those below, but of sufficient power to resist four times the weight to which they can ever be subjected. The level of the flooring is five feet below that of the surrounding streets; and the object of thus sinking the floors is to obtain a more imposing view of the building as the visitor enters from the domes at each end. He will, therefore, ascend two steps to a large platform or dais at each entrance, and from thence descend, by a flight of steps eighty feet wide, into the nave or transepts on three sides. There are four large courts: two of them 250 feet by 200 feet; two more, 250 feet by 86 feet wide; and two central courts, one 150 feet square, and the other 150 feet by 86 feet wide. All these are 50 feet high, covered with glass, and lighted from above. They are the only parts which resemble the Crystal Palace.

One important feature in which the Exhibition of 1862 differs from that of 1851, is the refreshment-rooms and arcades. They are built of brick, and overlook the whole of the Horticultural Gardens. Unlike its predecessor of 1851, where the refreshments were confined to biscuits, soda-water, and buns, those of the present Exhibition will be on a large scale, every description of refreshment being supplied in spacious dining rooms, 300 feet long by 75 feet wide; and the arcades on each side will be collectively about 1,500 feet in length, and 25 feet in width.

The annexe or machinery compartment, which extends along the west side of the Horticultural Gardens, is composed of four spaces, each 1,000 feet long and 50 feet wide, covering an area of 50,000 square feet. The whole of these constructions comprise a "ridge-and-valley" roof, composed of a very cheap material, and of very simple construction, namely, deal boards, nailed together in the form of arches, which spring from vertical standards of two 2½-inch planks nailed together to a height of 28 feet. These, again, support the gutter plank, where the feet of the rafters terminate, a little below the intrados of the curved arch. The roof frames are boards nailed together, and so disposed that the weight comes direct on their edges. The lower part of the roof is covered with boards and felt, and the upper part is glazed with skylights, having bearers for ventilation throughout the whole length of the three divisions.

This department of the Exhibition will be devoted entirely to machinery in motion; and, in order to give every facility to exhibitors, a large supply of steam from six 50-horse boilers, placed at the north-west corner of the Horticultural Gardens, will be conveyed in pipes laid in a tunnel the whole length from north to south, at the cost of the Commissioners. Provision is also made, by the introduction of large wrought-iron pipes, for carrying the exhausted steam clear of the buildings, from the numerous engines supplied by the exhibitors; and these again, with the necessary shut-off valves, will constitute the motive power to be employed in driving every description of machinery submitted for public inspection. In addition to the steam required for these purposes, upwards of 2,300 feet of 2½-inch polished shafting will be extended, at a height of 10 feet from the floor, for the accommodation of the exhibitors. The shafting will be supported on neat cast-iron columns, extending at convenient distances in lines along the middle of the different divisions, and of suitable lengths calculated to meet the requirements of the exhibitors and give motion to the different machines. In fact, the department of machinery in motion being entirely separated from the other parts of the Exhibition, there will be no risk of injury to any of the more delicate articles of manufacture, nor to those instruments which require to be kept dry and free from an atmosphere charged with vapour where steam machinery is employed.

From this description, it will be seen that the machinery department will of itself be a distinct and separate exhibition, probably the most perfect of its kind ever brought before the public. It will contain some of the most ingenious mechanical contrivances of this inventive age, and, from its extent, will furnish a collection of machines employed in almost every branch of manufacture, not only in this country, but from every part of Europe and America. In this World's Fair will be exhibited competitive machinery of every description, from the most ponderous steam-engines to the delicate lace and sewing machines. How suggestive of progress to the mechanic and artizan, and how interesting, will be the comparison of these unique operations when presented to the eye of every considerate and reflecting spectator! This combination of talent and the whole cunningly devised machinery of the useful arts being employed on their respective operations, is no common sight; and it is only in this deeply interesting department that we shall learn to admire and fully to appreciate the value of the inventive powers of the present age, and the purposes to which they are applied in the useful and the industrial arts.

Exclusive of the annexe for machinery, there is another of the same character ranging along the eastern side of the Horticultural Gardens, for the reception of agricultural implements and the larger specimens of metallurgy, mineralogy, and geology, and of heavy machines which do not require motion. To the farmer, agriculturist, and rural population, this portion of the Exhibition will afford examples of every improvement that has taken place for the last twenty years; and the young agriculturist need only employ his observation in order to make himself master of what is being done to attain still greater perfection in the tillage and the increased production of the soil. Here will be found every variety of hand-plough, scarifier, and grubber; and here, also, will be exhibited various descriptions of steam-ploughs, reaping-machines, straw-cutters, &c., &c.; and the most casual observer will not fail to derive benefit from such a display of the great and important features which, in machinery alone, have changed the face of the country, and almost quadrupled the produce of the land.

Our limited space will not admit of further description; but in closing this somewhat imperfect account of the Great International Exhibition Buildings, it may be proper to advert to the security of the whole structure, which is due to the excellent designs of Captain Fowke, placed in the hands of the contractors, Messrs. Kelk, and Charles and Thomas Lucas Brothers, for execution. To these gentlemen every praise is due for the liberal and efficient manner in which they have performed their contract. The whole of the responsibility for the execution of the works rested on them and their engineer, Mr. Meeson, C.E., who prepared the working drawings to be submitted to a Building Committee, consisting of the Earl of Shelburne, the writer, and Mr. W. Baker, who undertook to act for the Commissioners in conjunction with Captain Fowke and the contractors above named.

The general features of these large structures have no claim, according to the opinions of some persons, to architectural design, but they are admirably adapted to meet the requirements of the Exhibition; and the long vista of the nave, with the domes and transepts at each of the east and west entrances, will convey to the spectator a sense of perfect harmony as regards altitude, magnitude, and general effect, seldom to be met with in public buildings. Independently, however, of architectural considerations and an imposing exterior, the great and important aim of the Building Committee was to see that every part should be made secure, and that no danger could possibly arise through a want of due proportion in the different parts, and of the needful strength in everything that might affect the public safety. On the part of the contractors, every alteration, and all the wishes of the architect and committee have been cheerfully and liberally conceded, and the result is the following letter, confirmatory of the trials and experimental facts arrived at in testing the resisting powers of the different floors and girders, and the great domes covering the points of intersection of the nave and transepts:—

"To the Commissioners of the International Exhibition.

"My Lords and Gentlemen,—Feeling that it would be a source of satisfaction to the Commissioners, as well as to ourselves, as members of the Building Committee, and also a due precaution for the public safety, that the gallery and other floors of the International Exhibition Building, at South Kensington, should be thoroughly proved, we undertook a series of experiments on Monday last.

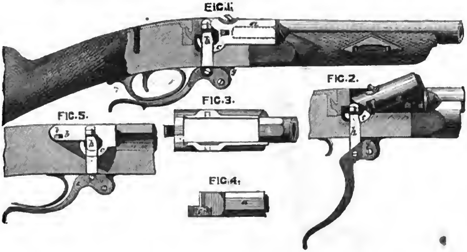
"We have to report that, in carrying out these experiments, the various floors and stairs were put to a more severe test than they would be subjected to with the largest number of people that could possibly be assembled upon them at any time during the Exhibition. The results of these experiments fully bear out our calculations on the strength of the different

---

[*] Louvre, lover, or loover, from the French word *l'Ouvert*—the opening.

Digitized by Google

MURCOTT AND HANSON'S BREECH-LOADING FIRE-ARMS.



parts of the structure, and we feel perfectly satisfied as to the stability of the building for the purpose for which it was intended.

"The two large domes, in the strength of which we have taken great interest, were eased from their temporary support last week, and no observable settlement took place.

"The following are the particulars of the tests:—the first caused a large body of men, about 400 in number, to be closely packed upon a space 25 feet by 25 feet, on one bay of flooring; we then moved them in step, and afterwards made them run over the different galleries, and down each staircase; at the same time we caused the deflections of the girders carrying these floors to be carefully noted at several places, and had the satisfaction of finding that in each case the deflections were very nearly the same, thus exhibiting a remarkable uniformity in the construction. The cast-iron girders, with 25 feet bearings, deflected only one-eighth of an inch at the centre, and the timber trussed beams of the same bearing placed between these girders deflected half an inch at the centre. In every instance the girders and trusses recovered their original position immediately on the removal of the load.

"We are, my Lords and Gentlemen, yours faithfully,

"Wm. Fairbairn, } C.E.
"Wm. Baker,

"London, Feb. 13."

Before the dimensions, forms, and conditions of the columns, girders, trussed beams, and rafters had been decided upon, a long series of preliminary experiments were carried on, and it was not until the Building Committee and Captain Fowke were fully satisfied as to the security of every part, that the building was allowed to proceed. Not satisfied with these early precautions, the Building Committee resorted to the final and still more severe tests of impact and concussion as produced by marching the large body of men linked together over stairs and galleries at quick and afterwards at "double step," stamping hard on every part of the bays of 25 feet square. All these precautions have been taken to secure the public safety when placed under every conceivable condition in which they can be loaded by a moving mass of people.

Amongst the most prominent features of these buildings, and those that have created anxious consideration on the part of the Building Committee and the engineer, Mr. Meeson, are the great domes. These large constructions (designed on a scale greater than anything of the kind had ever been done before) were carefully considered, in order to be within the limits of the estimates, and at the same time to ensure ample stability in the structures. They were originally calculated to sustain a force of 40lb. per square foot, if such a force could ever be applied by the most powerful tempest ever known in this country, which, however, seldom exceeds 26lb. to the square foot.

On the whole, therefore, we are justified in coming to the conclusion that the buildings are not only secure, in so far as regards the public, but they are admirably adapted for the purposes intended; and it is our sincere wish that every other feature in the Exhibition may prove satisfactory to the Commissioners—that their object may be fully realized in a brilliant success!

MURCOTT AND HANSON'S BREECH-LOADING FIRE-ARMS.

The above engravings illustrate an invention patented a short time back, by Messrs. Murcott and Hanson, Gunmakers, of the Haymarket, London.

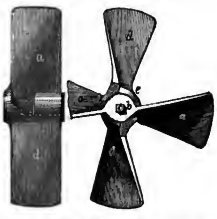
The Invention applies to those guns in which a charge chamber is fitted at the rear of the barrel, and consists in an arrangement hereafter described for opening and wedging up the chamber for the insertion of the charge into it, and for tightly and securely closing it prior to and at the discharge of the arm. Behind the chamber for holding the charge a slot is cut across the metal in a piece with the metal which forms the chamber, a curved tail is formed on the rear and lower end of the metal; to the stock under the chamber the front end of a lever is hinged, the rear end of which, when the breech is closed lies and is held by a catch against the trigger guard; between the front of this lever and the trigger guard there is hinged a vertical wedge.

Fig. 1 of the engravings is a side elevation, partly in section, of a portion of a fire-arm with the charge chamber closed ready for firing; Fig. 2. is a similar view of the same arm with the chamber open ready for the insertion of the charge; and Fig. 3 is a plan of the rear end of the barrel, with a box or case for the reception of the charge chamber. *a* is the charge chamber, a detached view of the under side is given at Fig. 4; *b* is the slot in the metal behind the chamber *a*; and *c* is the curved tail piece. The chamber *a* is laid in the box, Fig. 3, which is inserted in a recess formed in the stock at the rear of the barrel *d*; *e* is a lever free to move upon the stud *f*, passing through the lug *g*, connected to the under side of the stock; *h* is a wedge. The wedge is free to slide in a groove corresponding in shape with a notch *k* cut on the wedge; the wedge *h* passes through the stock and is connected at its lower end to the lever *e*: the curved tail *c* lies under the rounded edge of the wedge *h*; *l* is a bolt passing through the side of the stock and box, through the slot *b*, and screwing into the box on the other side.

The action is as follows:—Upon the lever *e* being brought down, that is, in a direction away from the trigger guard, it takes hold of the curved tail *c* on the charge chamber *a*, causes it to play upon the stud or bolt *l* passed through the slot *b*, disengages the chamber from the rear of the barrel *d*, and causes it to tilt upwards at front, as shown in Fig. 2, to receive a charge. On the lever being returned to the trigger guard, the vertical wedge *h* causes the nose of the chamber to descend, drives it forward into the rear of the barrel, and rises to wedge and hold the whole chamber securely in its place, as shown in Fig. 1; the back of the wedge abuts against the rear of the chamber frame.

Fig. 5 is a side elevation of a portion of a cone gun, fitted according to this Invention. In this case the cone plug is depressed instead of being raised.

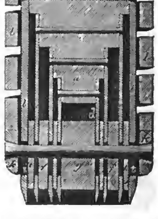
BRITT'S FOLDING PROPELLER.



This invention, patented by Mr. T. Britt, St Thomas's-terrace, Old Kent-road, is intended to remove a difficulty hitherto felt, in raising a four-bladed propeller up through the well of a ship, by the usual apparatus, when it is necessary for repairs or inspection.

a a are two blades formed in a piece with the boss *b*, these are mounted on a shaft *c*, which is carried just into the post. *d d* are the other two blades, one of which is formed in a piece with the boss *e*, the other is fitted on by screws. This boss *e* has a portion cut away, to allow the smaller boss *b*, which passes through it, sufficient play to enable the blades *a a* to be folded up against the blades *d d*, when they are to be lifted. The larger boss is furnished with a suitable chuck to connect with the main shaft.

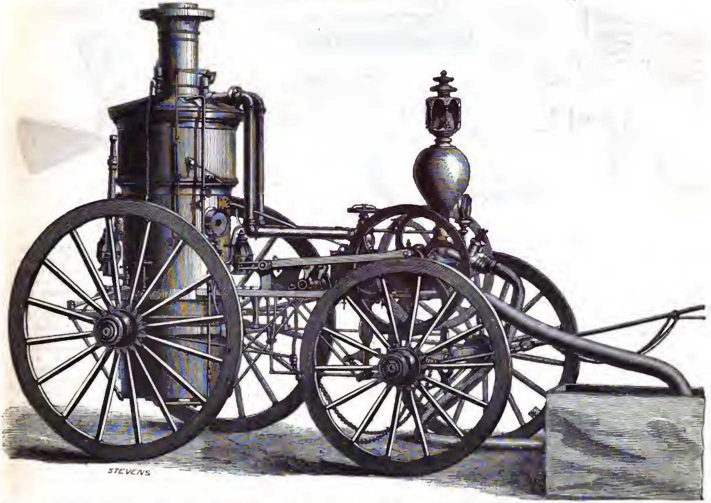
SCOTT'S TOOL FOR CUTTING WASHERS AND LACES.



Mr. J. Scott, of Worcester, has recently protected by letters patent, tools or cutters for the manufacture of leather rings and washers. The tool is composed of a fixed punch *a*, with a series of concentric circular cutters *a*, *b*, *c*, *d*, having annular pistons *e*, *f*, *g*, working between every two, all the pistons are connected to a cross bolt *h*, and the bolt to a ring *k*, the bolt is free to

LEE AND LARNED'S STEAM FIRE ENGINE.

(From a Photograph by Chappins, Fleet Street.)



move in slots *i*, *i*, cut in and through the cutters; a helical spring *l* is placed outside, this bears at top against a ring *m*, and at bottom against the ring *k* to force the pistons down upon and push the washers from between the cutters when the tool is raised by the press or other apparatus to which it may be fitted. The tool for cutting laces consists of a cutting blade fixed or bedded spirally in any suitable holder, the spaces between the coils of the spirals determine the width of the lace. A movable piston may be used with this tool or the lace may be withdrawn by hand. The length of the lace is determined by the number of coils in the cutting blade; space is left in the centre of the tool, so as to form an enlarged head at the end of the lace, or a head may be formed at each end, so that by dividing the lace in the centre two laces are formed, each having a head at one end.

LEE AND LARNED'S STEAM FIRE ENGINE.

The annexed illustration represents one of Messrs. Lee & Larned's Steam Fire engines, which has been recently added by Mr. Frederick Hodges, of Lambeth, to his fire-extinguishing apparatus. A fortnight since we recorded a most successful trial of this engine.

It is made to be drawn by hand, and intended for the use of volunteer firemen, so that small towns and cities may avail themselves of the superior and efficient power of steam for the suppression and extinction of fires without the expense of a horse establishment. The engine is about ten feet in length exclusive of the draft pole, and weighs 3,700 pounds. Having large wheels and extremely sensitive and beautiful springs, it runs easier than the average of first class hand engines. The steam power is derived from one of Lee & Larned's patent annular boilers of 125 square feet of heating surface, with which steam can be raised to a working pressure in seven minutes.

The pump, which is of gun-metal, and highly finished, is Cary's patent Rotary, and is driven by a single reciprocating engine of seven inches diameter, of 8½ inches stroke, with a pair of light balance wheels, to carry it over the centres. It is intended to make from 300 to 400 revolutions per minute.

A flanged disc cast on the pump shell makes one of the heads of the steam cylinder; the two thus combined forming a steam pump of novel form and great simplicity and compactness, occupying indeed so small a space (only 27 inches in length), that they are hardly seen in the engraving. The piston-rod passing out through the opposite head, acts on a cross head of such length as to allow a connecting rod from each end of it to pass the cylinder and take hold of cranks on the pump shaft.

The slide valve movement is obtained by means of a rocking shaft actuated by an eccentric on the main shaft. The boiler is supplied by one of Giffard's feed-water injectors, the feed pipe coming from the bottom of the air vessel.

The carriage frame is in front simply a horizontal plate of iron of less than a foot in breadth expanding behind into a ring which encircles and in fact supports the boiler. This end of the bed or frame is hung in platform springs by means of tension rods and braces taking hold of the iron ring. The centre of gravity is directly over the hinder axle which opens into the ring by which the boiler is suspended.

The springs are flat plates of steel one or more to each, of uniform thickness, but tapering in width from the middle towards either end. In front two springs of this form are used, placed one above the other in line with and directly under the bed, thus receiving the weight of the machinery at the middle or widest part. These serve the twofold purpose of spring and reach, taking hold in front by means of forked ends, on swivel boxes at each end of a short vertical shaft, forming a universal joint with the front axle, thus giving a single point of front suspension counteracting the tendency of the bed to twist under its load in travelling over rough roads, thereby protecting the machinery against the concussions of travel, and dispensing with the complication and friction of a fifth wheel.

These engines are built of several different sizes, and some are made self-propelling, the one however which we have described is the smallest. The next size larger, weighing 6,200 pounds, is also a hand engine (though either can be fitted to be drawn by a horse or horses if required), and being of greater power, it is to be preferred where the condition of the street is favourable in respect to surface and grades.

The engine is on the whole as fine a piece of mechanism and workmanship as we have ever seen, and this opinion can be confirmed by the many scientific gentlemen who have witnessed it, including Mr. John Scott Russell, Mr. J. E. McConnell, Mr. Kitson, Mr. Sturrock, and many others. Messrs. Easton, Amos, & Sons, the hydraulic engineers of Southwark, are now engaged constructing an engine in many respects like the above illustration, with the addition that it will carry its own fuel and hose.

A large iron caisson has recently been constructed for use at Sheerness Dockyard, to increase the dockage space at that establishment.

Proceedings of Societies.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

On the evening of Saturday, the 5th inst., a very full meeting of members of the above society took place at their rooms, 35 St. Swithin's Lane, City. Mr. Joseph Newton of the Mint, President, occupied the chair; and his resumption of it after partial recovery from a severe illness of two months' duration, was hailed with general congratulations. When the routine business and the election of several new members had been completed, Mr. John M. Oubridge, of Messrs. Simpson's, Pimlico, proceeded to read a paper on "Cast Iron." He regretted, primarily, that pressure of duty had prevented his devoting as much time to the preparation of the paper as its subject demanded, and then proceeded to say that considering the relative importance of cast iron to this, the first mechanical and scientific nation in the world, little was known of its varied qualities and characteristics. Very much had been said about iron no doubt, and at the present moment especially, the word was on the lips of statesmen and politicians, as well as of mechanical and scientific men generally. Malleable and not cast iron, however, was the theme of the majority of discussions which were now so rife, but as a practical founder he might be pardoned for confining his own remarks to that kind of material of which he best understood the nature, namely, cast iron. Generally speaking, there were no fixed rules or formula laid down for the guidance of those who conducted the processes of founding castings of iron, and foremen of foundries were consequently left much to their own individual ingenuity and talent, in conducting the work entrusted to them.

Let his hearers take into account the varieties of pig iron in use, how diversified were they in their nature? The density of pig iron frequently varied to the extent of 12lbs. in the cubic foot. Its cohesive strength of course ranging proportionably. In point of crystallization again, what diversity was found! Some iron, for example, made from the black band ores of Scotland, was remarkable for the large size of its crystals. In the process of crystallisation this iron did not require such an amount of supply as the Staffordshire irons. Then, if a comparison were instituted between the black band ore and the red hematite ore as to cohesiveness, it would be found that the first possessed little of that qualification—at all events until it had been frequently remelted, whilst the hematite possessed it in a remarkable degree, when melted at once from the pig. The fusibility and the fluidity of iron differed, too, exceedingly. The rich black band iron of Scotland retained its fluidity much longer than either the Staffordshire, Welsh, or Cleveland irons. Then coming to the question of purity, the "Bowling" pig iron was distinguished by its firm grain, the "Blaenavon" for its freedom from dross, and the "old Park" for the fine polish of which it was susceptible. In using other kinds of iron it was found, that while in a fluid state impurities were constantly rising to the surface; and as yet no laws have been laid down for the guidance of the practical founder, who was obliged to resort to the "rule of thumb," in default thereof.

Scientific men, chemical and otherwise, were much at fault in respect to these and other matters connected with cast iron. The mixtures of various irons for producing castings suitable for the diversified purposes to which they were put, were only empirically known. This was a wide field of scientific research, but he—the reader of the paper—for one should be glad to see more scientific labourers employed in that field. He did not claim any especial merit for knowledge of the science of metallurgy but he regretted that so little had been done by others in that particular branch of science. The fact was that iron founders as a body had had to grope as it were their way forward through difficulties and failures, first trying this mode and then that, drifting from Scylla to Charybdis, and like the Warrior or the Defence, without an adequate steering apparatus to keep them off the rocks.

To some extent employers, perhaps, were responsible for this state of things, both as regarded their inattention to the subject and their engagement of men ignorant of metallurgical science to conduct their foundries. When the serious and disastrous failures of castings in iron were taken into account, surely little enforcement from him was necessary to demonstrate that the making of such castings was not understood. There was a hap-hazard about the process which too often was revealed by the sacrifice of human life. The fatal beam of the Hartley Colliery engine was a case in point. It was an open sand casting of irregular thickness, as regarded its bosses and ribs, and the power of supplying the requirements of crystallization by heads of pressure, was absent at the time of its formation. Every one whom he was addressing probably knew that a plate of iron cast in open sand was one third weaker than when cast covered, and with a sufficient head to give it uniformity. It was strange that the Hartley beam had been cast without this simple precaution having been taken, and he thought that for the honour of the founding trades generally it was desirable to mention the fact. He trusted rather than thought, however, that this was an isolated case.

The principles which should guide the founder, in the method of supplying crystallization, seemed to be but little understood. How frequently had he in daily experience to meet this difficulty, and how often was the difficulty not found too great to be surmounted? For himself he might say that he had paid some attention to this important branch of his subject. Some year ago, when in Liverpool, several large rolls for sugar mills were to be produced in the foundry with which he was then connected. Repeated failures in making sound castings occurred, and all the "heads" and all the "feeding" they could give seemed to be of no avail. The want of homogeneity soon became visible in the latter. A half a dozen rolls were condemned. Being consulted by the head foreman on the matter, he (Mr. Outridge) suggested that instead of four heads, one above each arm of the roll, the mould should be made some eighteen inches higher, and an annular head double the thickness of the roll be furnished. This plan was adopted, and no more failures occurred. The same system he now always applied in casting large cylinder covers, the bosses of engine beams, and other works of a character which demanded homogeneity and perfect crystallization.

Hitherto that expensive schoolmaster, experience, had been the founders only teacher. Science could scarcely be said to have shed its "rays divine," upon them, whilst all around its beams were illuminating dark places, and "telling" upon almost every department of social existence. What they wanted was a special treatise on practical iron founding. Every other branch of manufacture almost, had its text book, and its organ or organs of information, the practical iron-founders had none. Men whose names stood high in the scientific and mechanical world possessed but meagre stores of information in reference to iron founding, and when they ventured to speak about it this fact was made painfully apparent.

A "Manual of Civil Engineering" had lately been produced by Professor Rankine, and the MECHANICS' MAGAZINE had spoken eulogistically of it. He wished that some one competent for the task, would publish a "Manual of Iron Founding." Some few of the questions which such a book should resolve, he would enumerate. The most improved method of moulding. The different qualities of iron, and how to judge them. The effects of sulphur on iron. Of manganese. Of arsenic. Of sulphate of lime. Of sulphate of copper. Ores, and how to distinguish those best suited for particular purposes. The effects of crystallization. Of expansion and contraction. The different kinds of coke and its effects upon iron. How to manage a furnace. The methods of smelting iron. And lastly—though we are only on the threshold of queries—the proportions of different kinds of iron to be used for particular purposes—and why? Mr. Oubridge trusted that his hint for the publication of a manual might be adopted, if the right man or men could be found to compile it, and thanking his audience for the attention they had paid to his paper, sat down amid considerable applause.

Mr. Buckle confirmed the reader's statement as to the perplexities which beset the practical founder, and named some eminent men who had done good service to the country by pointing the way to improvement in the founder's art.

Mr. Keyte spoke of the difficulties in the way of obtaining iron of uniform character and quality, but feared experience and experiment rather than "bookish theory" must as yet be the guide of the iron founder. Messrs. Shotton, Soward, Ives, Briggs, and Warner, followed in the discussion, which was in the highest degree practical and instructive, and the President in proposing a cordial vote of thanks to Mr. Oubridge took occasion to compliment that gentleman upon the suggestive and valuable paper he had contributed. It was such papers as these which drew out the funds of practical knowledge which foremen engineers possessed, but which modesty, or want of confidence, or some other feeling which he could not analyse, induced them to keep pent up in their own breasts. He trusted that at their next meeting a paper would be forthcoming on wrought iron, especially as applied to the sheathing of ships of war.

The vote of thanks was passed unanimously, and the meeting adjourned till May.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, March 27th. Mr. F. Campin, President, in the Chair.

On Retaining Walls.—By Walter Rutt.

The author commenced by remarking upon the impossibility of ascertaining the exact weight or condition of the earth, which rendered it impossible to calculate with mathematical exactness the thickness or form of wall required to sustain it. He then proceeded to consider the various ways in which a retaining wall may fail. It may yield bodily in three ways :—

1st. It may turn over, revolving forward upon the foremost point of its base.
2nd. It may slip forward, whilst still retaining its erect position.
3rd. The earth may yield to the pressure of the superincumbent weight.

The same three things may occur within the substance of the wall itself, viz :—

1st. A portion of the wall may break loose from the lower part and fall forward.
2nd. The upper part may slide upon the course below it.
3rd. The material of which the wall is composed may be crushed by the pressure.

The effect of the earth upon the wall was then treated of, it being considered that the prism of earth between the wall and the line of rupture had a tendency to slide down the line of rupture as down an inclined plane, thus exerting a pressure upon the wall at ⅓rd of its height parallel to the line of rupture. By setting off a length in this direction to represent the pressure and a vertical length to represent the weight of the wall, the resultant pressure upon the base is found. If the centre of pressure fall within about ⅜ths of the width of the base from its foremost edge, it may be considered a safe proportion. The farther back the centre of gravity of the wall lies, the farther back will be the centre of pressure, thus showing the advantage of giving a batter, and especially a curved batter, to the wall. By considering each point in the height of the wall as the base of a distinct wall it will be seen that the wall may taper off to a point at the top, giving a triangular profile.

To prevent the courses sliding upon one another, it is best to lay them square with the latter, sloping slightly downwards towards the back; an inclined base will also prevent the foot of the wall from being pushed forward upon the earth below it. The yielding of the earth below the foundations is a frequent cause of failure, which should be guarded against by extended footings, or in bad ground, by the use of piles. A very good example of this is seen in the quay wall of Rouen, which stands on a bank of soft mud, the river deepening rapidly in front, and is supported upon a system of piles braced together by transverse timbers.

Thus far, walls of uniform section only, have been considered; but by the use of counterforts the centre of gravity may be thrown farther back, and an increased strength be obtained with the same materials. Care must be taken to insure a perfect bond between them and the body of the wall, or, as in the case of the old Humber Dock, the latter may be forced forward, leaving the counterforts some feet behind. A still greater advantage is gained by placing the buttresses in front, or by building deep piers at intervals with vertical arches between them, which system has been adopted upon the Hampstead Junction and the Metropolitan Railways.

Another point requiring great attention is drainage, earth saturated with water not only being heavier, but its natural slope being greatly flattened, its action approximates to that of a dense column of fluid. On the Camden incline of the North-Western Railway the sides of a cutting through the London clay are supported by retaining walls about 25 feet high having a curved batter; the wall upon one side bulged considerably in consequence of the accumulation of water behind it, the other one stood firm, the inclination of the strata acting as a natural drain. The failing wall was operated upon by boring through it and inserting drain pipes 16 feet into the clay, which had the desired effect of letting off the water and preventing any future bulging. To make all sure, cast-iron struts were thrown across from one wall to the other. Iron struts are used to great advantage on the North-London Railway, and also on the Metropolitan Railway. In the latter case the walls are constructed on the principle of deep piers of brickwork at intervals of 11 feet, having vertical brick arches turned between them backed with concrete. They are carried up straight to a height of 15 feet above rails, where the struts are placed; above this point the face has a batter of 1 in 8, the back being still vertical. The struts are made in two lengths, bolted together in the centre, and stayed with T irons which run longitudinally from one to the other. The feet of the piers are retained in position by brick inverts backed with concrete.

The material employed in retaining walls must necessarily depend upon local considerations, the necessary qualifications being weight, and resistance to crushing. Where stone is very abundant dry walls may be used, as is the case in a wall at Rowsley, sustaining an embankment of the Midland Railway extension to Buxton about 25 feet high. There being a quarry in the immediate neighbourhood it was built dry of sandstone grit, 11 feet thick at the botton, 5 feet 6 in. at the top, and with a batter of 1 in 4. Where mortar or cement is used, the wall must not be exposed to great pressure until it is well set. In the late extension of the Surrey Docks, owing to the sudden lowering of the water, portions of one of the walls (although 20 feet thick in brick and concrete) bulged to such an extent as to necessitate reconstruction.

Concrete, from its cheapness and monolithic character, is a first rate material for retaining walls, but as it disintegrates upon exposure to the weather, it should be protected with a facing of brick or stone (good care being taken to

Digitized by Google

ensure a perfect bond), as in the extension of the London Docks at Shadwell, or by iron piling and plates, as in the Brunswick wharf at Blackwall. Mr. Mallet's buckled plates are well adapted for this purpose.

The author concluded his paper with a description of the Blisworth cutting on the North-Western Railway, where a heavy mass of limestone had to be un rpinned in order to prevent its forcing out a stratum below it saturated with water.

The paper was illustrated by several designs and diagrams.

MEETINGS FOR THE WEEK.

Mon.—*Royal Geographical Soc.*, I. "The Fiji Islands: their Commercial Resources, &c.," by M. Bensusan. II. "Report on the late Government Mission to the Fiji Islands," by Dr. B. Seemann, at 8.30 p.m.

Medical Soc., at 8.30 p.m.

London Inst., "On Birds," by R. Owen, Esq., at 7 p.m.

Wed.—*Geological Soc.*, I. "On some new Labyrinthodont Reptiles from the Edinburgh Coal-Field," by Prof. Hoxley, Sec. G S. II. "On the Thinning-out of the Eocene Strata of the London Basin to the west," by W. Whitaker, Esq., F.G.S. III. "On a Fresh Water Deposit beneath the Drift, near Ulverstone," by J. Bolton, Esq., at 8 p.m.

London Inst., "On the Seven Metals of the Ancients," by F. Field, Esq., at 7 p.m.

Thur.—*Soc. for the Encouragement of the Fine Arts, Conduit-street*, Third Conversazione of the Season, at 8 p.m.

Linnæan, at 8 p.m.

TO CORRESPONDENTS.

Received.—Capt. N., W. A., W. H. T., J. B., J. K., T. B. S., G. C., R. E., W. C., P. H., T. B., W. and C., T. and Co., R. H. D. for F. K., E. A. Brimson (the plan you mention was patented in 1859, see patent No. 2091 for that year), Capt. B. (the Special Committee on Iron has its office at No. 2 Victoria-street, Westminster, where plans of armour plating are received and examined).

Correspondence.

◆

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

◆

FLOTATION AND PARALLELISM.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

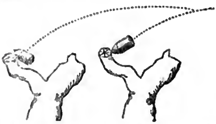
Sir,—There has of late been much controversy between the theorists on the so called parallelism of the picket or bullet fired from a rifled arm.

In the course of some experiments on the Prism Rifle Sight, which you had the goodness to notice in a late number of your magazine, I obtained by a fortunate accident what I cannot but regard as a complete exposition of the fallacy of the argument in favour of parallelism, in so far at least as the Jacob bullet is concerned. This bullet, or picket, has projections corresponding to the grooves from which it is fired, cast upon it, and has a solid base, with an acute spherical-coned point.

At the range of 1,000 and 1,500 yards, the bullets struck a bank sloping upwards at an angle of about 38° or 40°. Here they encountered a soft turf about twelve inches thick, terminating on chalk.

The ramrod was passed into the holes until its point encountered the *base* of the bullet, and then a clean cut was made in the turf directed by the ramrod. Thus the path of the bullet was exposed from end to end. In no case was the hole larger than what might be fairly due to the diameter of the bullet, and the bullet was always found lying point foremost against, or in the chalk, at the same angle at which the ramrod showed that it had entered.

Besides this evidence, I have now to refer to an accidental and very strong corroboration of the fact to which it points.



In firing from the 1,000 yard range, there happened to be a small holly tree very near the target. An overhanging branch of this tree, no larger in diameter than one of the bullets, was fairly struck in the centre. The bullet passed clean through, shattering the fibres at the side farthest from the rifle, but on the side nearest to it the orifice caused by the projectile closing up completely. Now had the bullet been as at *A*, in a position of parallelism as regards its axis, it must have cut the branch (which grew nearly in a horizontal direction) off. It could only have struck it as at *B*, and as there was no possible cause of deflection in the line of flight—as every other bullet was found lying in the same curve, *i.e.*, the axis coinciding with the trajectory, I submit that here is a very indigestible fact for the advocates of "*flotation*" and parallelism.

I have left the branch and bullet with Mr. Daw, the gun-maker, of Threadneedle Street, whose rifles have yet to take their place, and I fully believe it will be a high one, in the active competition which is now going on.

Any further evidence I may be able to give in elucidation of what must be a very important point, will always be at the service of any of your readers or correspondents; but for myself, I confess that I have never been able to see what analogy existed between *flotation* in air and *flotation* in water, having always been taught to believe that air quoad bullets is really a "*circumambient* fluid."

If indeed such a body as a "picket" were projected from a smooth bore, at a diminished velocity, we should very likely have parallelism showing itself, simply because the centre of gravity is placed very far back in these projectiles, and therefore the rear end droops, much as an arrow would do, if it were badly balanced, or had a weight on it near the feather. I shall hope to see a rational refutation of this conclusion (if there be one) in your pages, or failing that, an acknowledgment that neither fish *in* water, nor bullets in the air, can be said to float, in the ordinary meaning of the term, which involves the presence of two media differing in density, as air and water. It is undoubtedly true that by a forced construction, the phrase "beat in air" has been used, but this is not to say, as is here attempted to be done, that one side of a truly symmetrical body can be upborne or floated by that air which resists it equally on both upper and under sides, but is a mere poetical comparison of the easy motion of birds, &c., in air, with that of truly floating bodies in water.

In conclusion, I would ask any one who is often at the rifle range to look at a bullet which has fairly struck the target from a distant range. First, he will see that the mark on the said target is never elongated, but always circular. Secondly, if he picks up the bullet, which, supposing him to be a good shot, he may often do, he will find that the front or point of the bullet so fairly strikes on the target that *it becomes inverted*, and where the cup, or boxwood plug was, there is now a conical projection from the former base of the bullet, sometimes showing the rim of the hollowed base surrounding it.

Yours truly,
J. N. Selwyn, Capt. R.N.

◆

UNITING ENGLAND AND FRANCE BY RAIL.

Sir,—Neptune, the writer of the article in the *Whitehaven Herald*, which you were pleased to copy last week, feels a "strong conviction" that his scheme for uniting England and France by rail "will attract the attention of capitalists and eminent engineers." As I belong to neither class, I should not have troubled him with my assistance had he not seemed puzzled to find out the quantity of material that would be necessary to carry out his project. Anxious to aid him in developing his gigantic enterprise, I have gone into the calculation, and find that to make the embankment he proposes, would require 5,000,000,000 cubic yards of material, which at 5s., would only cost £1,250,000,000 sterling, and would employ 10,000 men for 1,369 years and 315 days, allowing each man to *mine*, *transport*, and *deposit* in the sea one cubic yard per day. Trusting that these figures may be useful to Neptune in assisting him to work out his magnificent scheme.

I am, Sir, your obedient servant,
A. B. C.

London, April 8, 1862.

[N.B. It would be interesting to know by what process A. B. C. arrived at the above-mentioned results.]

◆

THE MERRIMAC AND MONITOR.

Sir,—It appears that on the attempt of the Merrimac to run down the Monitor, she sustained considerable damage, and made no impression upon the Monitor, but the reason why this result was produced has not yet been explained.

I would suggest that the prongs of the Merrimac acted as supports to the Monitor at the time of the collision and that the length of the prongs were only levers to damage her own bows, and, further, that in all cases as between iron-clad vessels, the same result will follow.

If the Merrimac had not been provided with the prongs, I think she would probably have run down the Monitor, but that any number of Monitors would prove a match for the Warrior, I think is an absurdity, and that she will be able if necessary to run down any number of Monitors (provided of course that her stern is sufficiently strong to bear the collision) in the same way that a moderately sized steamer will run down a heavy laden coal barge.

If the Merrimac had been built according to nature, her sting would have been in her tail, by which her speed would have been increased, and by running full tilt against the Monitor, would probably have disposed of her at once, and afterwards of the wooden vessels by stern way with her prongs. I am, Sir, your obedient servant,
J. Parker.

Camberwell.

◆

STAT FERREA TURRIS AD AURAS.

Sir,—In the event of any war, or rumours of war, with America, how is Lord Palmerston to send reinforcements to Canada? A few improved Monitors would effectually prevent the landing of troops from wooden transports, and a dozen iron Warriors could not convey with certainty troops across the Atlantic. The late Secretary of State for War declared that "There is no sum that Sir William Armstrong could ask would be considered too great for his invention." Our present Secretary of State for War is in favour of stone, that is, fixed batteries. But the Americans acknowledge that their splendid Rodman guns, throwing round shot of 425lbs. weight from fixed batteries, could not hit the Merrimac. The obvious reason is, that beyond the point-blank distance of 400 yards, the arch of the trajectory becomes so high—that to hit an object is very uncertain. Why do we not cast guns after the Rodman fashion to throw such smashing shot! My patent will enable Government not only to cast such guns, but also to cast guns of the "Aitch gun-metal" to throw shot of 1,000lbs. weight. Captain Cole's Monitors, "patroling" on the coasts of England, would effectually prevent invasion by France, or any other great power.

I am, yours obediently,
J. Norton.

Howard's Hotel, Kingstown, April 4.

◆

STEERING SHIPS.

Sir,—Your frequent remarks and letters of your correspondents upon this subject tell me that some improvement is required. I should be glad to hear if there be any objections to propelling and steering by the propeller according to my plan patented in 1852, a model of which may be seen at the Royal United Service Institution. The whole gear is simple, submerged, and effective to propel or turn a ship quickly at *her moorings*, or to steer her when under weigh, when sailing, or steaming. The letter of Y. Z., in your number, March 28th, speaking of Mr. Fyer's patent as having been invented by Colonel Maccrone, reminds me that Mr. John Ericsson showed me the same plan, which he was trying in 1834, at which period I designed the submerged direct revolving screw shaft as first introduced by him in 1837, and which was adopted after by Mr. Smith in the Archimedes, and which remains in use to this day.

I have tried my propelling and steering plan under steam in the Sethgon, and found that it requires no more force to steer by it than the ordinary rudder. It is obvious, that steam rams, block ships, and screw ships can be most effectively turned speedily in every direction by this mode. With reference to Mr. T. B. Mansfield, of Teignmouth, his plans of auxiliary rudders appear to me to be the same as Mr. Mulley's, of Plymouth, and may be seen in my model before-mentioned.

I am, your obedient servant,
George Beadon, Capt. R.N.

◆

A SCREW-ENDED SHOT.

Sir,—If a bolt for a rifled cannon had an augur point, with more or less of the screw attached, would it not, at a short range, pierce the iron skin of any vessel? Has this ever been tried! Yours very truly,
Petricola.

Gossip.

◆

In the course of a series of excellent lectures on Mechanics, which he has been recently delivering before the British Horological Institute, Mr Hislop, its honorary secretary, has very clearly explained some of the phenomena of the laws of nature. In reference to the case of gravitation particularly, his remarks have been instructive in the highest degree. In the actions and postures of animals and of man especially, he says, "many instances occur illustrative of the properties of the centre of gravity. If a man walks or runs, he inclines forward that the centre of gravity may overhang its base, and he must then be constantly advancing his feet to prevent his falling whilst he makes his body incline just sufficiently to produce the velocity he requires. In pulling horizontally at a load he thereby causes his body to overhang its base so that its tendency to fall may become a force or power applicable to the work. When a person stands on one foot and leans forward in the attitude in which the statue of Mercury is usually exhibited, the other foot is elevated behind in order to bring back the centre of gravity, so as to be vertically over some part of the foot on which he stands. But in consequence of the convex and irregular form of the foot, the basis afforded by a single one is in reality very narrow; hence, when we attempt to stand on one foot we often find it necessary to use muscular ex in order to bring the point of support to that side towards which we are beginning to fall, and when the basis is still more contracted the body never remains at rest, but by a succession of actions of this kind, often too minute to be visible, it is kept in a state of constant vibration without ever attaining such a position as would give it any degree of positive stability. Thus it is by habit alone, that the art of rope-dancers and balancers is attained.

The correspondence between the Treasury and the trustees of the British Museum on the subject of providing additional accommodation for the varied collection belonging to the great national establishment has been published. From this it would appear that the trustees are resolved to separate the plethoric contents of the present museum by removing the departments of natural history, including those of geology, mineralogy, zoology, and ethnography, to a new building to be erected on the estate of the exhibition of 1851. By the removal of these collections from the museum an area of some 65,000 feet will be left vacant, and this may be appropriated chiefly to exhibition rooms for coins, medals prints, engravings, &c., &c., and more space for the library, which grows larger at the rate of 30,000 volumes annually. It is understood that the Treasury regards this proposition with favour, and that it is probable a Bill will be introduced to Parliament embodying it. We trust that if the legislative body sanctions it, it will be with the provision that the designing as well as the execution of the Branch Museum be subject to competition amongst the architects of the kingdom generally. We want no more such specimens of architectural skill as the South Kensington Museum and the building for the International Exhibition.

We have frequently had occasion to call attention to the tramways recently put down in some of the streets of London by Mr. Train. We have regarded them as public benefits, and such we believe is the opinion of a vast majority of the inhabitants of the metropolis. But Mr. Train has been singularly unfortunate; in fact he has not had fair play. He has not been permitted to carry out his plans and extend the benefits his trams would confer on society. At Bayswater he was defeated by an aristocratic clique. In Victoria-street he was the victim of local prejudice, and in Kennington-road he has been checkmated by an obstinate and impatient jury. Being present at the trial at Kingston, we can speak from practical knowledge. Mr Train and several of the Lambeth vestrymen was indicted for causing a nuisance by the Lambeth tramway. Several witnesses was examined for the prosecution, and before a single witness was called, or a single word was said on behalf of the defendents, the jury interrupted the trial and said they were perfectly satisfied the defendants were guilty. Possibly they might have come to the same conclusion, had they heard what could have been said on the other side; but the very least they could have done was to have let the trial take its ordinary course, and decide according to the evidence. But they exhibited an indecent haste. "Strike but hear," is a motto as old as the hills. The Kingston jury were determined to strike without hearing; and if one of their number is to be believed, they made up their mind before they came into court. If so, they were untrue to their oaths, wherein they undertook to decide not in obedience to preconceived notions, but according to the evidence. We are surprised at the unusual and unfair course taken by the jury, and we are equally surprised at the judge permitting such a farce to be enacted in a British court of law. The counsel for the defendants stated that they were prepared to submit overwhelming evidence to prove that the Lambeth tramway was almost universally appreciated, and that thousands every week participated in the benefits it conferred; and that instead of being a nuisance, it was a public convenience. But the jury were deaf to everything but their own prejudices and one-sided opinion. Hence justice miscarried in their hands. We hope for the sake of fair play and the character of Englishmen, that the defendants will have the right of appeal to a higher court.

Mr. J. Nasmyth in a letter to the *Times* says;—Ever since 1845, when I first introduced the subject of steam-rams to the Admiralty, I have given my earnest attention to the subject, as one of the most simple and effective agents in naval warfare; and, having watched the results of the experiments that have been made on iron plates, by which we seek to render our ships of war invulnerable to shot, experience and reflection have satisfiied me that, unless we provide ourselves with *bonâ fide* steams rams, great as the shot-resisting capabilities of our iron-plated war ships may be not one of them could exist above water after receiving on its side a single blow from an iron-plated steam ram of 2,000 tons. Such a weight of ram, moving with a velocity of 8 or 10 miles an hour, would, if it deposited its momentum on the side of the strongest iron plated ship, transcend in the destructive effect of one single blow all the broadsides that could be delivered during hours of continued firing. As the grand object of naval warfare is the destruction by the most speedy mode of ships of the enemy, why should we continue to attempt to attain this object by making small holes in the hull of the enemy when, by one single masterly blow from a steam ram, we can crush in the side of any armour-plated ship, and let the water rush in through a hole 'As wide as a church door,' and certain to send her below water in a few minutes? No iron plates however thick, as forming the sides of an iron-plated war ship, could ever withstand the crushing in action of an end-on blow from a steam-ram possessed of the momentum due to 2,000 tons, moving with even so moderate a velocity as 10 miles an hour. While such a crushing blow would be fatal when delivered on to the side of the enemy, the result to the steam ram would be practically harmless.

W. A. of Milford, has written us a letter, in which he endeavours to prove the utter defenceless state of Great Britain. His letter begins, "The wolf is out, and God only knows how soon it may be prowling about our shores." There is a party of men in this country known as the "peace party," who would, it is insinuated, leave England in a weak and defenceless condition. There is another party with whom we have much less sympathy—we mean "the panic-party."—W. A. says, "the wolf is out." Who is the wolf we should like to know, and from what quarter is he likely to come. The French Government is economising and retrenching. Russia has enough to do to keep down Poland, and emancipate her serfs. Austria has more than enough to do to keep down Venetia and Hungary. The energy of the United States of America are absorbed in the most gigantic civil war ever recorded in history. Experience has recently demonstrated the opinions and predictions of this magazine. We must now abandon wood and adopt iron in ship-building, and spend more money in floating batteries and less on land fortifications. But there is no necessity for an indecent haste in the matter. There is no nation sufficiently strong to attack us, with the slightest probability of success. Let us not become the victims of a groundless panic, and again act in haste to repent at leasure. We have a great work to do, but let it be done thoughtfully, scientifically, economically, and well. We have time and opportunity to maintain our position intact, without being frightened from our propriety, and without insulting foreign governments by imputing to them "wolfish motives."

The trustees of the British Museum have issued the following notice:—"In order to give the public generally the utmost facilities for seeing the British Museum during the time of the International Exhibition at Kensington, the trustees have laid down the following special regulations:—1. That the Museum, instead of being closed from the 1st to the 7th of May next, be closed on Monday, the 28th of April, and reopened the following Monday, the 5th May. 2. That from the 5th of May to the 30th August inclusive, the reading-room be kept open for readers as usual, daily, Sundays only excepted; but not later than five o'clock. 3. That the Museum collections including those parts of the library of printed books and manuscripts to which visitors are now admitted on public days, be kept open daily, Thursdays and Sunday only excepted, from ten o'clock in the morning till eight in the evening, during the month of May, June, July, to the 16th of August inclusive; but till half-past seven only for the remainder of the next month. 4. That during the same months and days the reading-room and a small portion of the libraries annexed to it, as well as the whole of the north library, with the exception of the western extremity, be open for the admission of the public generally only from five o'clock to eight, or half-past seven, as before mentioned; and that from nine to five o'clock none but readers for the purpose of study be admitted to the reading room or to any of the libraries, except such of the rooms as are usually accessible to visitors throughout the year on public days. 5. That after five o'clock the reading-room and the library generally be not used for the purpose of study. 6. That Thursdays be reserved for cleaning the several departments, and that no visitors except readers be admitted into the Museum on this day.

"At the present moment," says the *Independance Belge*, "may be seen in a garden at Fexhe-le-Haut-Clocher, Belgium, a fine cherry tree not in blossom, but bearing good-sized cherries. It is true that the tree has been covered every night with matting, and has been for some weeks passed watered with luke-warm greasy water. This is a remarkable instance of precocious vegetation."

It is said that a new projectile, adapted to the 11-inch Dahlgren guns of the Monitor, has been made at the Cold Spring foundry, at West Point. One of them was driven through a solid plate of wrought iron eight inches thick, placed at an angle of 45°.

At a recent meeting of the microscopical section of the Manchester Philosophical Society, Mr. Cheetham exhibited a prism, which he uses to illuminate objects under the microscope with the variously coloured lights of the spectrum in succession, instead of ordinary light. He finds that details of structure are more distinctly brought out by some of the colours than others; the blue and green rays are also very pleasant to work with, and easily varied by throwing the required part of the spectrum on the mirror below the stage.

At the same meeting Mr. Sidebotham brought before the notice of the meeting Mr. Petschler's process for producing vegetable forms with crystals of bichromate of potash in gelatine, which was discovered by him in the preparation of glass plates for photographical purposes, and exhibited at the Microscopical Soirée given to the British Association at the last meeting. Specimens on large glass plates were handed round, which, when magnified, aptly represent mosses, ferns, and algæ, in beautiful ramifications, which vary in many ways, dependent upon the strength of the solution, temperature, state of the atmosphere, and other causes. Mr. Sidebotham called especial attention to the peculiarity of the form of crystallisation, and to the fact that an inorganic salt, in contact with organic matter, should produce vegetable forms.

The production of crinoline is going on at a flourishing rate in Sheffield. One firm, which we could name, alone sends out no less than twenty tons weekly of the delicate material, whilst the total weekly "make" of the cutlery capital amounts to no less than 150 tons. This rate of manufacture has been maintained throughout the whole of what we may now term, let us hope, the past winter, and promises to increase as the summer advances. Who shall say that fashion is not necessary to the sustentation of mechanical industry, when Sheffield has so thriven by its vagaries? Already enough crinoline has been manufactured there to encircle the globe again and again.

Captain Cowper Coles in a letter to the *Times* says:—I wrote in a letter last October to the Admiralty—viz., that I will undertake to prove that on my principle a vessel shall be built nearly 100 feet shorter than the Warrior, and in all respects equal to her, with one exception; that I will guarantee to disable and capture her in an hour; she shall draw four feet less water, *require only half the crew* and cost the country for building at least 100,000*l.* less. I am ready to fall or stand on those assertions. I must again say that my comparisons with the Warrior are merely made to develop the progress of a new engine in warfare, but that I and every Englishman must be proud of the Warrior as the first-born babe of our iron-clad family.

In addition to the iron frigate Achilles, 50, 6,079 tons, 1,250 horse power, building at Chatham dockyard, the following squadron of iron vessels are now under construction by private firms for the Admiralty, several of which are in a very advanced state—viz., the Agincourt, 50, 6,621 tons, 1,250-horse power, building at Birkenhead; the Northumberland, 50, 6,621 tons, 1,250-horse power, and the Valient, 32, 4,063 tons, 800-horse power, building at Milwall; the Minotaur, 50, 6,621 tons, 1,250-horse power, and the Orontes, 3, 2,812 tons, 500-horse power, building at Blackwall; and the Hector, 32, 4,063 tons, 800-horse power, building at Glasgow. The following iron-plated frigates are now building at the several Royal dockyards, the whole of which are intended to be afloat during the present year—viz., the Caledonia, 50, 4,045 tons, 800-horse power, at Woolwich; the Ocean, 50, 4,045 tons, 1,000-horse power, at Devonport; the Prince Consort, 51, 4,045 tons, 1,000-horse power, at Pembroke; the Royal Oak, 50, 3,716 tons, 1000-horse power, at Chatham; and the Royal Alfred, 50, 3,716 tons, 800-horse power, at Portsmouth. In addition to the above there are no fewer than 31 line-of-battle ships and other screw steamers now on the stocks at the several dockyards, most of which are admirably adapted for conversion into shield ships, on Captain Coles's principle. Of these the Bulwark, 91, at Chatham; the Repulse, 91, at Woolwich; the Robust, 91, at Devonport; and the Zealous, 91, at Pembroke, are all in a very advanced state, requiring only a comparatively small outlay to plate them with iron. There are also three first-class 51-gun frigates also building—viz., the Belvidera at Chatham, the Tweed at Pembroke, and the Dryad at Portsmouth,—which are admirably adapted for conversion into armour-plated ships. They would not require the removal of any decks, as would be the case with line-of-battle ships, but would only have to be lengthened and strengthened to enable them to bear the increased weight which would be placed on them. Of the other vessels in progress several are intended to carry 22 guns and upwards. If completed as iron-cased steamers they would be larger and of greater tonnage than either the Monitor or Merrimac. The whole of the hands have been removed from the wooden ships building at the several dockyards, and are now employed on the iron-cased frigates under construction, five of which will be afloat by the end of the present year.—*Times*.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment :—

Steam Engines, &c., 2329.
Boilers and their Furnaces, &c., 2364.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2338, 2357, 2365, 2369, 2374, 2376.
Ships and Boats, including their fittings, 2330, 2337, 2342, 2343, 2344, 2349, 2359, 2378, 2381.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2327, 2353, 2354, 2373.
Food and Beverages, including apparatus for preparing food for men and animals, 2386.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2328, 2331, 2334, 2348, 2358, 2367, 2372, 2384.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2332, 2335, 2380.
Lighting, Heating, and Ventilating, 2326, 2339, 2356, 2361, 2383.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2336, 2345, 2347, 2352, 2355, 2368.
Metals, including apparatus for their manufacture, 2366, 2370, 2377.
Chemistry and Photography, 2351.
Electrical Apparatus, 2387.
Warfare, 2375, 2382.
Letter-Press Printing, &c., *None.*
Miscellaneous, 2333, 2340, 2341, 2350, 2360, 2362, 2371, 2379, 2385.

2326. E. A. Cooper. *Improvements in apparatus for freeing gases from dust and other particles of matter floating therein, and for causing vapours or gases to be absorbed by liquids.* Dated Sept. 18, 1861.

This consists in causing a large extent of surface wetted with a liquid to be exposed to the gas in a finely divided state. *Patent abandoned.*

2327. H. Wickens. *Improvements in reaping and mowing machines.* (A communication.) Dated Sept. 18, 1861.

These machines may be used either as combined reapers and mowers, or merely as reaping machines; the difference in the machines being the provisions made in the mower, apart from the reaper, for a longer stroke and quicker motion of the knives than is required for reaping grain. *Patent abandoned.*

2328. C. Partington. *Certain improvements in machinery or apparatus employed in the manufacture of paper* Dated Sept. 18, 1861.

The object here is the separation of the superfluous liquid from "half stuff in order to prepare it for the willow and washing machine." The improvement consists in the employment of one or more pairs of bowls or rollers, supported in a framing, between which rollers the material in the state of half stuff passes, and is pressed until sufficiently solidified for the next operation. The material is fed to the rollers by means of an endless travelling cloth. The upper roller is formed or composed of large discs placed side by side and loose upon the central shaft. *Patent completed.*

2329. A. J. Barr. *Improvements in the valves of steam and other motive engines.* Dated Sept. 18, 1861.

This invention relates to reducing the pressure of steam on the slide valves of steam engines, and thereby reducing the friction of the working surfaces; and consists in constructing on the back of the slide valve a shallow cylinder, which communicates with the interior of the exhaust port of the valve by means of a small hole. In this cylinder is fitted a piston which is secured to the face of the back plate, and is provided with suitable metallic or other packing. The face of the back plate rests upon antifriction rollers, which are placed by the ends of the valve in the steam chest. Steam being admitted to the steam chest will act with the same pressure on the back of the back plate as is due to the area of the piston in the shallow cylinder, and the back plate being supported on the antifriction rollers, and properly balanced in the steam chest, the friction of the working parts, or faces of the valve and ports, will be considerably diminished. *Patent abandoned.*

2330. G. Parry. *An improved anchor.* Dated Sept. 18, 1861.

Here the inventor connects the shank of an anchor to the arms by a ball and socket joint or connection, so that the shank may move in various directions, and take various angles or positions with respect to the arms while still remaining connected to them. This can be effected, for example, by forming the shank with a rounded spherical or ball, and fitting and working in a hollow or socket in the crown. He generally forms on the inner side of the crown, or at the throats of the anchor, as many recesses, openings, or grooves as there are arms, and such recesses, openings, or grooves leading into or forming part of the hollow or socket in the crown, so that the shank, when inclined, may fall into one of the said recesses or openings, and bear or rest against the corresponding arm. He prefers to construct the anchor with three fluked arms. *Patent abandoned.*

2331. C. Sackow and E. Habel. *Improvements in machinery or apparatus for opening and cleaning cotton and other fibrous materials.* Dated Sept. 18, 1861.

This consists of a shaft capable of rotating in suitable bearings, having a cone fixed up it to which spiral or screw vanes are attached; this arrangement is surrounded by a fixed cylindrical casing, having screw vanes screwed to its inner periphery. The front edges of the screw vanes upon the cone describe a plane at a right angle to the shaft, and are made either with or without teeth, and act upon the cotton or other fibrous material fed to them by toothed or fluted rollers, or other arrangements; thus, by the rotation of the shaft, the screw vanes not only act upon the cotton or other fibrous material so as to detach and open it and drive out the seeds and other matters, but at the same time produce a strong current or blast of air, which propels the detached fibrous materials into and through a chamber formed by a fixed cone joining up to the rotating cone, both together forming a double cone with their bases together, and a conical continuation of the cylindrical casing. Portions of the exterior casing of this chamber are made of net work, which permits the dust and other foreign matters detached from the fibrous materials to be carried away by the blast or current of air, but retains the loose fibre (thus freed from dust and other matters), and delivers it to a suitable arrangement of rollers or other mechanism for making the same into laps if required. *Patent completed.*

2332. J. Gurman. *Improvements in the fittings and method of hanging window sashes, to facilitate their removal for cleaning and other purposes.* Dated Sept. 18, 1861.

We cannot here give space to the details of this invention. *Patent completed.*

2333. L. G. A. Condroy. *An improved centrifugal apparatus, intended for purifying, washing, drying, moulding, or extracting from liquids, substances or materials of various kinds, which are deposited or poured for this purpose in moveable baskets or boxes fitted into the said apparatus.* Dated Sept. 19, 1861.

The substances to be submitted to the action of the centrifugal machine, are, according to this invention, operated upon in baskets or perforated boxes, lined inside, if necessary, with a woollen or common coarse cloth, or with a wire cloth. The substances to be treated can be placed previously in the baskets or boxes, so that they can be partly drained before putting them in the apparatus, and after the operation or drying process is over, they are taken off and carried to the storehouses or gathering halls, whilst fresh baskets or boxes, previously prepared, are submitted to the same process, and so on, as fast as the first baskets are emptied and filled up anew. *Patent completed.*

2334. J. Glover. *Certain improvements in machinery for preparing cotton or other fibrous substances.* Dated Sept. 19, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2335. J. C. Coombe and S. Wright. *Improvements in the manufacture of stones, bricks, tiles, slabs, statuary, and such like materials, and in the method of, and means for, cleansing and indurating the same when employed in buildings or for building purposes, and for preserving them from atmospheric and other influences.* Dated Sept. 19, 1861.

The patentees propose to make use of a solution of silicate of potash, weak or strong as required by circumstances, and then to add to this solution a sufficient quantity of hydro-fluo-silicic acid, weak or strong as required, but preponderating in its equivalent, so as to leave the mixture decidedly acid. *Patent completed.*

2336. J. Durant. *An improved form of coal-box, combining within itself a cinder sifter, and ash and dust pan, and receptacles for other requisites connected with domestic fire-stoves.* Dated Sept. 19, 1861.

This consists in forming a coal box or coal scuttle, the upper portion of a truncated conical form, with a lid on the top, by which the coal is introduced or withdrawn. In a compartment underneath that in which the coal is deposited, is placed a gridiron bottom capable of being moved backwards and forwards by a handle which projects; the outer front of this gridiron slide is formed so as to cover the front of the compartment and render it dust tight; the cinders and ashes being placed on the slide, (which acts as a shovel) it is inserted into the compartment and moved backwards and forwards, the ashes falling down into a lower compartment, the cinders remaining in the shovel. Instead of the backward and forward motion, a rocking or oscillating motion may be given to the cinder sifter. The ashes passing from the sifting chamber fall into a compartment beneath, which is also dust tight, and into a dust pan, when they may be removed at leisure. A portion of this upper part of the coal compartment is separated by a partition, and in this is placed wood for fire lighting, brushes for stove polishing, matches, and such like articles. *Patent abandoned.*

2337. C. W. Eddy. *Driving the bow of a ship of war with a shell, and a beak to be fitted or unfitted at pleasure, and to be used conjointly or separately.* Dated Sept. 19, 1861.

This consists, 1, in a method of applying at the bow of a ship of war a beak for the purpose of cutting down or smashing in the side of an enemy's ship. 2, In a method of applying a shell at the bow of a ship of war for purposes of destruction. The shell and beak can be fitted and unfitted at pleasure, and may be used conjointly or separately. *Patent abandoned.*

2338. R. Clark. *Improved means or apparatus for preventing accidents on railways.* Dated Sept. 19, 1861.

The object here is to indicate the position of a railway train within a tunnel and its exit therefrom, and this is effected by means of a pendant so placed as to receive an impetus from the funnel of a passing locomotive. The pendant is connected with certain wires for giving the desired signal. *Patent abandoned.*

2339. E. Breffit. *An improved fuel.* Dated Sept. 19, 1861.

This improved fuel is formed by combining coal with wood, by forming boxes or cases by preference, of or about the size of building bricks, and filling the same with the coal. The inventor fixes a cover on the box so as to completely enclose the coal. The said boxes or cases being perfectly clean may be placed on the fire by hands, may be stored under a table or otherwise in the apartment where they are to be burnt, and when placed in the fire ignites more readily than coal by itself. *Patent completed.*

2340. W. Clark. *Improvements in machinery for the manufacture of fishing and other nets.* (A communication.) Dated Sept. 19, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2341. W. T. Tongue and J. Green. *An improved portable self-acting water-engine for extinguishing fires, and other purposes.* Dated Sept. 19, 1861.

This apparatus may consist of a cylindrical or other shaped air-tight vessel, which is by preference formed with a dome-shaped top, having a pipe passing through the centre thereof, and extending down nearly to the bottom of the interior of the vessel. The head of this vertical pipe above the top of the vessel is fitted with a stop-cock and a suitable screwed collar, for attaching thereto the nozzle-pipe, or the end of an air-pipe of an air-pump, by means of a union nut. The side of the vessel at about two-thirds from the bottom is fitted with a small tap or screwed vent for allowing the escape of air during the time of charging the vessel with water. The vessel is charged with water through the vertical pipe, the air escaping through the tap in the side of the vessel. When the water has risen to about two-thirds of the height of the vessel the tap is closed, and to the head of the vertical pipe is attached the end of an air-pipe connected with an air-pump, which pump may be temporarily fixed to the side of the vessel. By means of the air-pump the patentees force into the cylinder the required quantity of compressed air, after which they close the tap on the head of the vertical pipe, and then remove the pipe of the air-pump and replace it by a flexible pipe fitted with a suitable nozzle-piece, when the apparatus is ready for use, all that is required being to turn on the stop-cock and direct the nozzle in the direction the stream of water is desired to take. The air-pump can, if preferred, be worked with a lever or crank-handle, and fitted with a fly-wheel. *Patent abandoned.*

2342. J. H. Wilson. *Improvements applicable to pumps.* Dated Sept. 19, 1861.

This invention applies chiefly to ships' lift-pumps, and consists in placing the lower valve in a chamber on the head of the suction pipe, and enclosing the top of the chamber with an air-tight cover, and constructing the working barrel on the side and parallel with the chamber on the head of the suction pipe, a side opening or port being formed to connect the chamber on the head of the suction pipe at a point above the lower valve with the bottom of the working valve, which is provided with an upper valve or bucket of a peculiar construction, and consists of an annular ring of cast metal forming the valve seat, and having an arch springing therefrom for connecting it with the pump rod. A cupped leather is placed on the horizontal annular ring, which is kept in its place by a flat annular ring or washer screwed on to the under side of the cupped leather by headed screws, which pass through the bottom of the cupped leather, and are screwed into the under side of the valve seat. The cloak or cover of the valve is formed in the ordinary way, and the centre of the cupped leather is removed to the extent of the outer port. By the arrangement the patentee is enabled to obtain a cheap and serviceable pump bucket; that as it requires little labour to fit, the side of the cupped leather accommodating itself to any irregularity on the side of the casting forming the valve seat. The lower valve is provided with a hollow screwed plug, which has a lateral opening in the side about the middle of its length, the object being to admit air under the lower valve when it is desired to remove it for examination or repair, or removal, or for sounding the pump well, which can be readily done by removing the cover on the head of the chamber in which it is enclosed. *Patent completed.*

2343. T. Silver and T. Moore. *Improvements in the construction of and appliances to steam-ships or other vessels.* Dated Sept. 19, 1861.

The specification of this invention comprises much detail which we cannot, with advantage, devote space to here. *Patent abandoned.*

2344. J. Graham. *A double acting force or lift pump for ships, fire-engines, and other purposes.* Dated Sept. 19, 1861.

This consists of a double acting force or lift pump, which the patentee constructs with two chambers, and with two buckets or plungers working in each chamber; the rod of the bottom bucket or plunger in each chamber works through an orifice in the upper bucket or plunger, made water-tight by a movable brass packing, so as to allow the rod to work it without a parallel motion. Motion is given to the bucket in each chamber, so that when the one is ascending the other is descending, the upper bucket moving up and down in the upper end of the chamber, and the lower bucket up and down in the lower end of the chamber, meeting or nearly so in the middle of the chamber. There are other arrangements included. *Patent completed.*

2345. S. Hawksworth. *Improvements in the manufacture of floor cloth, and in ornamenting other surfaces.* Dated Sept. 19, 1861.

Here linseed oil is boiled slowly, or simmered in a close vessel, or boiled for some days, with a small proportion of litharge and Burgundy pitch, until they become of a consistency somewhat similar in fluidity to tar; this compound is then placed in a masticator or mixing machine, and combined with suitable colouring matters, earths, or pigments, so as to produce any desired colour, and such colouring matters may be so used and mixed as to imitate marbles or stones when rolled out into sheets. *Patent completed.*

2347. R. P. P. Dagron. *An improved microscope to be used for exhibiting photographic views and productions* Dated Sept. 19, 1861.

This invention is based upon a previous invention patented the 28th March, 1860 (No. 801), and consists, 1, of a double tubular image microscope composed of two cylinders, at the bottom of which are placed on each side two photographic microscopic images. 2. Of a tube joined to the two cylinders aforesaid, which serves to connect them together, and also to keep them asunder. This tube can be furnished with a partition to absorb the optic oblique rays. 3. In placing photographic microscopic proofs on glass, each joined by an achromatic lens; the distance between the two should be such that the focus of the first lens acts on the second image which is opposite thereto, and the focus of the second lens acts on the first image, so that in looking either way the front image appears enlarged by the ocular lens. *Patent completed.*

2348. T. Redwood. *An improvement in the manufacture of paper.* Dated Sept. 19, 1861.

This consists in the use of sulphite of zinc, which is added to the pulp of which paper is made, for the purpose of preventing the injurious effects of chlorine or compounds of chlorine which may result from the process of bleaching the rags, and also for improving in other ways the quality of the paper. The inventor has found the addition of about five parts of the sulphite to as much of the pulp as contains 100 parts of the dry ingredients to answer the purpose. *Patent abandoned.*

2349. T. M. Gladstone. *An improvement in the construction and forms of anchors.* Dated Sept. 20, 1861.

Here the inventor makes an anchor with a joint or pivot in the well known manner as Porter's, so far as the arms are concerned like them, but having palms that shall have a concave surface on the inner side, and the back of which shall be parallel to the back of the blade or thereabouts, declining from down the centre to the sides, the centre being in line with the curve of inside front of arm or thereabouts. The front of the palm that rests upon the shank on the upper side when in use, either rests in a groove fitted to it on the shank, or is prevented from leaving its impact on the shank by raised points on either side of the shank, whereby a great support is given to the joint at the crown and other parts on any strain being brought upon the anchor in veering the ship. He also makes what he terms a compound stock, to consist of top or bottom plates of proportionate length, breadth, and strength, to be bolted together so as to clasp the square of the anchor, and having between them, and secured at right angles, cross plates or clasps, that shall grasp the nut or nuts of the anchor, and between the plates in each arm of the stock is fixed wood to keep the plates asunder. *Patent abandoned.*

2350. B. Smith. *Improvements in taps or cocks.* Dated Sept. 20, 1861.

This invention refers to such taps or cocks as act by the raising and lowering of a valve by means of a screw, and consists in certain arrangements whereby the stuffing box through which the spindle of the screw is ordinarily made to pass is dispensed with, and leakage around the said spindle prevented. *Patent abandoned.*

2351. J. Oliver, J. Grantham, W. Sinnock, and M. R. Leverson. *Improvements in the mode of obtaining certain chemical substances, and in the treatment of vegetable fibres, and in obtaining manurial and other products therefrom.* Dated Sept. 20, 1861.

This consists, 1, in improvements in the mode of obtaining alkaline salts and earthy chlorides. 2. In the application of the same to the treatment of vegetable fibrous material for the manufacture of pulp, suitable for making the various descriptions of paper articles of furniture and other works of art. 3. In the application of the organic matter, mineral, and saline substance extracted from the vegetable fibrous material operated upon, combined with phosphate and nitrogenous compounds, for imparting a high value to them as manurial compounds. *Patent completed.*

2352. N. Walter and D. Johnstone. *Improvements in castors.* Dated Sept. 20, 1861.

This consists in employing a ball, sphere, or globe of glass, or other suitable material, and causing it to work against three rollers placed in triangular positions, and turning upon pins or axes fixed to a metal frame, having a pivot working in a step or socket, which arrangement enables the ball to turn free of side friction. *Patent abandoned.*

2353. J. C. Davidson. *Improvements in thrashing machines.* Dated Sept. 20, 1861.

The patentee claims the construction of thrashing machines in which the external surface of the beaters of the drum are formed with a curvature in the direction of the axis of the same, and in which the "concave" is made to follow the curved surface of the drum in the direction of its axis. *Patent completed.*

2354. C. Praman. *Improvements in machinery or apparatus for cultivating land.* Dated Sept. 20 1861.

This comprises what may be termed a rotary forking cultivator, consisting principally of a cylinder (or any number of cylinders put together on the same axle to make the width or length required), capable of revolving in suitable bearings, attached to an iron or other frame, and rolling on the surface of the ground. The cylinder or cylinders may be of any convenient diameter and width, and is or are provided with holes or slots in which are fixed curved tines; they are placed in rows round the cylinder, and are capable of being placed nearer or farther from each other. Between each two of the curved tines, in a continuous row round the circumference of the cylinder, may be placed a blade or cutter (extending from one tine to the other) which cuts into the surface of the ground. As the cylinder revolves, the forks or tines and the cylinder are cleaned and scraped by a series of scrapers or cleaners placed behind, fixed to the iron or other frame. *Patent completed.*

2355. J. Burnand. *Improvements in the means of fastening or securing the handles of table knives and forks, daggers, and other similar articles, part of which invention is also applicable to ladles.* Dated Sept. 20, 1861.

This consists, 1, In enlarging the bore of the haft towards the heel. 2. In turning or soldering the tang and pouring in molten metal or alloy. *Patent completed.*

2356. G. Roberts and F. Lamb. *Certain improvements in lamps and lamp wicks, whereby they are adapted for more effectively burning animal, linseed, and other heavy and also glutinous and bituminous oils, and other burning fluids employed for illuminating purposes.* Dated Sept. 20, 1861.

This consists, 1, in adapting wheelwork to an ordinary moderator lamp for causing the wick to be regularly raised as the oil is consumed. 2. In making the surface of the bottom deflectors perforated. 3. In lamps intended to burn heavy oils, in forming a slit or opening through the outside of the burner, and affixing thereto a duct to carry off the superfluous oil. 4. In adapting to a vase lamp a tube fitted with a plunger operating upon wheelwork for raising the wick as the oil is consumed. 5. Perforating the burner above and below the glass holder. 6. In a method of making wicks for lamps. *Patent abandoned.*

2357. W. G. Creamer. *Improvements in railway brakes, and in apparatus for actuating the same.* Dated Sept. 20, 1861.

This consists in the application of a reserve power to railway brakes produced by a coiled spring, placed in a box in connection with the shaft in which the chain for applying the brakes is wound, the spring being composed of an alloy of metals, consisting of about 50 parts zinc, 30 parts of copper, 5 parts of tin, and 15 parts of antimony. *Patent completed.*

2358. G. T. Bousfield. *Improvements in machinery for combing cotton and other fibrous materials.* Dated Sept. 20, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2359. F. W. Wymer. *Improvements in apparatus used in sounding the holds of ships or vessels.* Dated Sept. 20, 1861.

Here the tube or pipe for the passage of the sounding rod is combined with the bulk head cock or valve, so as to enable the cock or valve to be opened and closed therewith, at the same time the tube admits of the sounding rod being passed down through it. *Patent completed.*

2360. G. T. Bousfield. *Improvements in machinery for manufacturing shoes for horses and other animals.* Dated Sept. 20, 1861.

This invention is not described apart from the drawing. *Patent completed.*

2361. L. R. Boomer. *Improvements in gaseliers, and in ventilating apparatus connected therewith.* Dated Sept. 21, 1861.

This consists essentially in the use of a second pipe or tube, in which the gas pipe (to the end of which the star is fixed) is placed, and this second pipe or tube is the ventilating pipe. The upper part of this pipe or tube passes through the roof into the open air, where it is covered with a suitable cowl or hood. *Patent abandoned.*

2362. C. Boaon. *Improvements in veneering presses.* Dated Sept. 21, 1861.

This invention consists in constructing veneering presses in the following manner:—Upon a strong wood or metal frame the patentee lays and secures a sheet or plate of zinc or other metal, on the upper surface of which he fixes metal bars, in such manner that series of chambers or passages extending from end to end of the plate are formed. He places strips of wood or other suitable material at the ends and sides, and he covers the whole with another sheet of metal similar to the first, in order to obtain a smooth and hollow bed on which to perform the veneering. Having formed the hollow bed, he places pipes below it in communication with the end of each of the passages, at one end of which he admits steam, hot air, or hot water, which, travelling along the passages, passes off at the other end. Clamps are fitted to the press, which, for convenience, he hinges at one end to the frame. *Patent completed.*

2363. H. and F. C. Cock. *Improvements in apparatus employed in the manufacture of gas.* Dated Sept. 21, 1861.

This relates to the dip pipe and hydraulic main, the object being to allow for the contraction and expansion, or rise and fall of the ascension pipe, and thereby to prevent the strain upon the joints of those pipes, and mouth-pieces of the retorts. *Patent completed.*

2364. J. Fenton. *An improved method of causing the water to circulate in steam-boilers.* Dated Sept. 21, 1861.

This invention consists in imparting an additional amount of heat to a portion of the water, at a point intermediate between the water level and the bottom of the boiler. For this purpose the inventor employs a vessel, or vessels for containing the portion of water to which additional heat is imparted, which is or are in communication with the water in the boiler, at or near both the water line and the lower part of the boiler; the superheated water, following a well-known law, rises to the upper part of the boiler, and is replaced in the superheating vessel or vessels, by the comparatively colder water from the lower part of the boiler, when that, in its turn becomes superheated, and rises to the upper surface, thus keeping up continuous circulation. *Patent abandoned.*

2365. W. Stableford. *Improvements in the manufacture of wheels, and in securing tyres on or to wheels.* Dated Sept. 21, 1861.

This invention is intended to apply chiefly to railway wheels, but may be applied for common road purposes. To the nave the patentee fixes a metal disc or series of segments or spokes, and bends down the outer edge to form a hook, either all round the disc or segments, or at intervals only. He forms the tyres with an inner web, and forms that all round or at intervals only into a hook. The hooks on the tyres and on the discs, segments, or spokes correspond, or are counterparts each of the other, and when put together interlock and form a tight connection, on each side of the hooked disc, segments, or spokes, and by preference with the grain placed radially. He fixes wood which bears against shoulders on the tyre at one end, and against the nave at the other—or instead of bearing directly against the nave, the wood is received in sockets, free to move on the nave. He then bolts, rivets, or fastens the metal core, and the two wooden surfaces together. In order to effect the bolting he prefers to apply on both sides of the wheel a skeleton frame, carrying two rings, through which bolts are passed and fastened by nuts. Instead of applying wood on each side of the core, metal discs, segments, or spokes may be used. In constructing wheels according to this invention, he prefers that the wood or metal on each side of the core should be placed at an angle between the tyre and the nave, in order to allow of tightening the tyre if it should wear loose, or otherwise require tightening, by causing the wooden or outer metal surfaces to approach more or less a straight line, that is, bringing them nearer together at the ends where they rest on the nave, or in the sockets upon the nave. *Patent completed.*

2366. A. Parkes. *Improvements in the manufacture of castings, rods, bars, bolts, nails, rivets, and sheets, when alloys of copper are used.* Dated Sept. 21, 1861.

Here it is preferred that the alloy should consist of fifty-five parts of the best and purest copper, forty-five parts of the best and purest zinc, and from a quarter per cent. to two per cent. of tin or aluminium. *Patent abandoned.*

2367. W. Tonbur. *Improvements in machinery for combing, heckling, and dressing fibrous materials.* Dated Sept. 21, 1861.

The specification of this invention is excessively voluminous, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2368. S. Desborough. *Improvements in the manufacture of pins for hair, dress, jewellery and other purposes.* Dated Sept. 21, 1861.

This consists in manufacturing the said pins from spirally formed wire. *Patent completed.*

2369. J. H. Dunley. *An improvement in the manufacture of axle boxes and bushes.* Dated Sept. 23, 1861.

This consists in casting the axle boxes and bushes for the wheels of carts, waggons, agricultural implements, &c., in jointed metal moulds, in lieu of sand, by which means the inner and outer surfaces of such castings are chilled and hardened, and the strength and durability of the article greatly increased. *Patent completed.*

2370. C. Stevens. *Improvements in the manufacture of steel and in the hardening of metals.* (A communication.) Dated Sept. 23, 1861.

Here the iron to be made into steel is immersed in a solution composed of 30 parts of Bone acid in crystals, to 1,000 parts of water at a temperature of 10° centigrade; the iron remains sufficient time for the liquid to completely penetrate the oxide of iron, it is then removed wet from the bath, and at once placed in a crucible or furnace for melting; heat is applied as usual. *Patent abandoned.*

2371. H. Plantrou. *Improvements in washing and scouring wools by the introduction of air into the water, using an aeriform washing apparatus.* Dated Sept. 23, 1861.

The principle of this method of washing wools rests entirely upon the introduction of air into the water, and the agitation which it produces therein. *Patent completed.*

2372. J. Kenyon. *Improvements in the treatment of yarns of warps previous to their being sized.* Dated Sept. 23, 1861.

This consists in causing the yarns or warps to pass through a trough or chamber containing steam or a boiling soap-water before they come in contact with size, which treatment opens the pores and fibres of the material, and enables more size to be absorbed or distributed in the yarns or warps. *Patent abandoned.*

2373. H. Brinsmead. *Improvements in apparatus for raising and stacking straw and other agricultural produce.* Dated Sept. 23, 1861.

This consists in using the framing and carriage of the combined portable thrashing machine as the chief support and portable carriage for the apparatus composing the the straw elevator. The improved apparatus elevates the straw after it has been submitted to the action of the shakers. *Patent completed.*

2374. V. Jankewski. *Improvements in carriages.* Dated Sept. 23, 1861.

The object here is to obtain an agreeable rising or falling, or undulating, or wave, motion to carriages adapted for the use of children or invalids. *Patent abandoned.*

2375. A. H. Hely. *Improvements in the construction of portable fire-arms.* Dated Sept. 23, 1861.

Here the inventor first constructs a weapon, consisting of a gun or rifle barrel, mounted upon a staff of tough and light wood, instead of a stock of the ordinary description; the said barrel will be surmounted by a sword bayonet, with a two-edged blade, one edge being curved like a scimitar. The said barrel may be permanently fixed on the staff, or capable of being detached. 2. He applies a cross-guard to the same weapon, consisting of a steel bar, which, when not in use, lies in a socket at the back of the barrel, but draws out when required for use through two eyes, the one fixed the other revolving, and locks itself in a catch at right angles to the said barrel, so as to form a means of defence against the cuts or thrusts from a sword or bayonet. 3. He mounts the said barrel in an ordinary lance staff (either with or without the said cross-guard), whether the blade of the lance be fixed as at present on the said staff, or is capable of being detached and carried separately. He applies the said cross-guard to ordinary guns and rifles, which may be done without altering their stocks or barrels, by using two additional straps, one a breech strap carrying the socket, and the other a muzzle strap carrying the eyes and catch for the said cross-guard. *Patent abandoned.*

2376. J. Poick. *Improvements in the permanent way of railways.* Dated Sept. 23, 1861.

Here it is proposed, in forming the joints or bridge of flat bottomed rails, to employ a wrought-iron chair of sufficient width to contain the flanges of the rail, and receive the fastenings of the bolts which secure the chair to the sleeper, such bolts passing through the chair, but not through the flanges of the rail, the edges of which they touch, or nearly touch, when in their places. The actual bearing of the portion of the chair beneath the rail joint is in the form of a flat plate, and the portions which extend laterally beyond the flanges are thicker than the central portion by the thickness of the flange of the rail, or nearly

Digitized by Google

so, which is thus held in a species of flat trough. A washer plate is laid upon each side of the chair, and projects some distance over the rail flanges at the joint or abutting ends of the rails, so that the bolts which are passed through these plates, and through the chairs will, when screwed up tight, compress the washer plates firmly down upon the rail flanges, and thereby hold the rail ends securely in their places. The same chair may be used in the sleepers next to the joints of a road formed of fish-jointed flat-bottomed rails. It is also proposed to use a dowel of wood driven tightly into the hollow of the rails at the joints, half the dowel being enclosed in each rail. *Patent completed.*

2377. J. Jacob. *Improvements in the mode of apparatus for obtaining and creating gas, and the application thereof to various purposes, parts of which improvements are applicable to the manufacture of iron and steel.* (A communication.) Dated Sept. 23, 1861.

The patentee claims, 1. the use and application of hydrogen gas, with or without the illuminating gas, produced with the hydrogen, as a reducing medium for the manufacture of metals. 2. The use and application of the hydrogen gas for the production of illuminating gas by mixing the same with volatile compound of carboretted hydrogen as described. 3. The mode of using hydrogen gas by transforming the same with volatile gas immediately before its distribution to the gas pipes and burners, as described. 4. The use of the simple condensing apparatus for the purification of the hydrogen gas, as described. 5. The improved mode of manufacturing iron and steel by using purified oxides, as described. 6. The production of cast steel in furnaces, without the use of crucibles, by the application of the gas melting process, as described. 7. The use of hydrogen gas in combination with atmospheric air or oxygen for blasting, as described. *Patent completed.*

2378. J. D. Parkes. *Improvements in a propeller of a ship.* (A communication.) Dated Sept. 24, 1861.

This consists in a system of propellers, improved and disposed, so that they act horizontally throughout their course, presenting their entire surface to the water in a rectilinear alterative movement, which is communicated to them by a simple transmission from any motive power. *Patent abandoned.*

2379. W. C. Wiley. *Improvements in pens and pen-holders.* Dated Sept. 26, 1861.

Here the patentee uses tongues or holders, which it is preferred should be of metal, and have but little elasticity, but depend for their elasticity on vulcanized india-rubber, or other material acting on them, so as to cause them to press towards the nibs of the pens, and to follow and remain in contact with them as they open in writing, and yet that the elasticity acting on the tongues may be overcome by the elasticity of the nibs of the pens. *Patent completed.*

2380. J. Sedley. *Improvements in constructing bridges and viaducts.* Dated Sept. 24, 1861.

This consists in combining the principles of construction employed in the formation of tubular and suspension bridges and viaducts, in such manner that the suspension shall form part of the tubular construction; and in place of having recourse to the use of caterings, &c., part of this invention consists in constructing tubular bridges and viaducts on an embankment or raised way, or on a suitable surface or way on the margin of the river or other water, or valley across which a tubular bridge or viaduct is to be placed, preferring to construct such raised or other way, with suitable rails or trams, in order that, when the tubular bridge or viaduct has been constructed inland, it may with greater facility be run out to the distance required, either to span the water or valley, or to partly span it in those cases where a bridge or viaduct is to be in two parts to meet and be connected intermediate of the width of the water or valley. *Patent completed.*

2381. G. J. Gladstone. *Improvements in apparatus for disengaging boats.* Dated Sept. 24, 1861.

Here an axis turns in suitable bearings, by preference near the bottom of a boat, and the axis is nearly long enough to reach from end to end of the boat. At each end of the axis is a crank, to which is attached a connecting rod, which, at its upper end, has a hook or eye formed to receive the hook of the lowering tackle. The hook or eye at the end of each of the two connecting rods is formed to open on a hinge. The point of a hook when closed is parallel with the upper end of the connecting rod, and the hook or eye passes between guides or plates which are only wide enough to allow the hook or eye to be received when the same is closed; hence, the connecting rod and the point of the hook, when at the lowest position, will be retained shut, but when the axis is turned partly round by a handle or projecting arm thereon, the upper end of each of the connecting rods will be raised to such a height as to release the point of the hook when the boat's tackle at both ends of the boat will be simultaneously released. *Patent completed.*

2382. T. Davey. *Improvements in the manufacture of safety fuses, parts of which are applicable to the manufacture of pipes and tubes of lead and other soft metal, gutta percha, caoutchouc, bitumen and earthenware.* Dated Sept. 24, 1861.

These improvements in the manufacture of safety fuses consist in coating the wires or fibrous materials, or both wires and fibrous materials, of which the fuse is partly composed with gutta percha, or its compounds, caoutchouc, waterproof varnish, soft metal, or other suitable adhesive material; also in the employment of wires as a substitute for, or in combination with, fibrous materials placed intermediately or covering such wires, or as a substitute for or in combination with lead or other soft metal. The parts of the invention which apply to the manufacture of pipes and tubes of lead and other soft metal, gutta percha, caoutchouc bitumen, and earthenware, consist in embedding in or incorporating wire with these materials during their manufacture, which may be performed in manner following. First, the patentee takes a wire or wires wound into a spiral or spirals, either one way or crossing each other, around and completely covering which he casts or moulds a short piece of pipe of the metal or material intended to be manufactured. He then passes such metal or material, with the wire embedded, through a series of rollers with graduated grooves, and draws it out on a mandril to the required length and diameter; or secondly he uses the more general mode of manufacturing pipes by hydrostatic or other pressure. *Patent completed.*

2383. C. & J. Watt, & T. S. Haviside. *An improved mode or method of bleaching palm oil.* Dated Sept. 24, 1861.

This consists in boiling palm oil in an aqueous solution of either sulphate of zinc or chloride of zinc, or sulphate of copper or sulphate of iron, or chloride of iron or calcium. *Patent completed.*

2384. J. Fawcett. *An improved material particularly adapted for the scouring, cleansing, and fulling of woollen or other cloths.* Dated Sept. 24, 1861.

Here the patentee boils lichen, commonly called "Iceland moss," in water, by which he obtains a firm and strong jelly. He also dries the lichen, and grinds it to a powder, and when required for use he adds water and boils or steams it. He then adds to the jelly soda, or soda ash, or other alkali which is thoroughly incorporated with the jelly. *Patent completed.*

2385. J. Cottrill. *An improvement or improvements in the manufacture of a certain description of needles.* Dated Sept. 24, 1861.

This relates to needles used for sail making, sack making, glove making, &c., and consists in making such needles square or four sided in section, or with five or more sides and angles, except at the head, which is of the usual form. *Patent completed.*

2386. G. Davis. *Improvements in the process of preserving provisions, and in the apparatus employed therein.* (A communication.) Dated Sept. 24, 1861.

This consists essentially in the use of two metal cases for cooking the provisions to be preserved, instead of one as usual, the second metal case being put in connection with the first at a certain part of the process, whereby a saving of time and improvement in the flavour and nutritious qualities of the provisions are effected. *Patent completed.*

2387. J. Banks. *Improvements in electro-magnetic telegraph printing apparatus or marking instruments, and the instruments or apparatus to be used in connection therewith.* Dated Sept. 25, 1861.

The patentee claims, 1, the construction, arrangement or parts, and mode of working electro-magnetic printing or marking apparatus. 2. The revolving armature and the mode of mounting and working the same in electro-magnetic telegraph apparatus. 3. The combination of the freely revolving marking disc with the direct acting striker. 4. The adaptation of the direct acting and freely revolving armature for the purpose of relay and transmission, all as described. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Dec. 16, 1861.

3062. F. Vetterlin, 14 Scarborough-street, Goodman's-fields, engineer. Improvements in breech-loading ordnance, and the projectiles to be used therewith, which may also be applied to small arms.

Dated Jan. 16, 1862.

119. E. H. C. Monckton, Fineshade, Northampton, esquire. Improvements in apparatus for obtaining and applying motive power.

Dated Jan. 20, 1862.

149. R. O. Doremus and B. L. Budd, New York, chemists. Improvements in making cartridges.

Dated Jan. 24, 1862.

188. T. Morris and R. Weare, Birmingham, electricians, and E. H. C. Monckton, Fineshade, Northampton, esquire. Improvements in submarine and other telegraphic communication, and in apparatus connected therewith.

Dated Feb. 4, 1862.

291. C. H. Roullier, Paris, manufacturer. Improvements in the manufacture of straps, bands, chains, and other like articles.

Dated Feb. 6, 1862.

315. P. H. Astley, 4 Matthew's-place, Stratford, Essex and C. Leighton, 3 Manby-grove, Manby-park, Stratford, Essex. Improvements in the construction of life-boats, applicable also to ships' boats, gun boats, and other vessels.

Dated Feb. 13, 1862.

387. R. Hornsby, jun., Spittlegate Works, Grantham, Lincoln. Improvements in apparatus for thrashing, elevating, cleansing, and separating grain, and in apparatus for elevating straw.

Dated Feb. 19, 1862.

439. F. Barnett, 230 Oxford-street An improved lamp or lantern for street lighting and other purposes.

441. N. Symons, ironfounder, 6 Cambridge-street, St. Pancras. Improvements in steam engines, for increasing the powers thereof by a different form of piston, internal top, and bottom of cylinder.

Dated Feb. 22, 1862.

475. G. T. Bousfield, Loughborough-park, Brixton. Improvements in apparatus for elevating hay, straw, and earth. (A communication.)

Dated Feb. 24, 1862.

494. T. Partridge, sen., 50 Tenby-street, Birmingham. Improvements in apparatus for printing railway and other tickets or cards.

Dated Feb. 25, 1862.

510. J. Whitworth, Manchester. Improvements in manufacturing and preparing projectiles, and in apparatus to be used for those purposes.

Dated Feb. 27, 1862.

540. R. Seager, Ipswich. Improvements in the manufacture of boots and shoes, and in apparatus employed therein.

Dated March 8, 1862.

619. A. W. Williamson, University College. Improvements in apparatus for generating steam, or for generating and superheating steam.

Dated March 10, 1862.

648. J. T. Callow, Staveley, Derby, manufacturer. An improved safety apparatus, applicable to cages or hoists used in mining or lifting machines.

Dated March 12, 1862.

678. E. G. Fitton, Ardwick, Lancaster, machinist. Improvements in machinery for winding yarn or thread on to bobbins or spools.

Dated March 13, 1862.

682. L. Vidie, Paris, gentleman. Improvements in the construction of aneroid barometers, partly applicable to steam gauges.

683. J. and R. Cunningham, Paisley, card perforators. An improved ornamental fabric, and improvements in weaving and in jacquard apparatus.

685. G. Ermen, Manchester, sewing thread manufacturer. An improved receptacle or case for the protection of threads, of cotton, silk, or other fibrous substances when in a "spooled," "balled," or otherwise wound state, or for the reception of tapes.

687. J. Wadsworth, Salford, near Manchester, machinist. Improvements in the construction and manufacture of moveable or adjustable heels for boots and shoes.

689. E. T. Hughes, 123 Chancery-lane. Improvements in furnaces for consuming smoke. (A communication.)

691. M. Henry, 84 Fleet-street. Improvements in stuffing boxes. (A communication.)

693. G. Calvert, Islington, ironmonger. Improvements in castors.

695. J. B. Howell. Improvements in the manufacture of chains and chain cables.

697. W. E. Newton, 66 Chancery-lane, C.E. An improvement in armour plates for vessels of war. (A communication.)

699. R. Schomburg, 90 Cannon-street, City, and A. Baldamus, Charlottenburg, Berlin. Improvements in purifying illuminating gas.

Dated March 14, 1862.

701. A. Quinard, 15 Passage des Petites Ecuries, Paris hardware manufacturer. A machine for manufacturing horse-shoe nails.

703. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in trusses or bandages, and in pessaries to be used therewith when required. (A communication.)

704. G. Bennet, 21 Manchester-buildings, Westminster. An improvement in the coating and covering of wrought iron, for the purpose of preserving it and preventing oxidation.

705. G. H. Sanborn, Boston, Massachusetts. Improvements in gas regulators. (A communication.)

707. G. T. Bousfield, Loughborough-park. Improvements in machinery for digging and disintegrating the earth for agricultural purposes. (A communication.)

709. M. A. Muir, Glasgow, and J. McIlwham, machinists. Improvements in railway sleepers and chairs, and in the mode of fixing rails.

Dated March 15, 1861.

711. A. and W. Coles, Wych-street, Strand, truss makers. Improvements in the construction of trusses for cases of hernia.

713. H. Emanuel, Brook-street, Hanover-square, jeweller. An improvement in the manufacture of ornaments for personal wear.

715. G. B. Pettit, New Oxford-street. An improved method of and apparatus for heating water and other liquids, applicable also to the evaporation of liquids.

716. J. Smadja, 16 Stamford-street, merchant. Improvements in bustles and crinolines, and in materials used in their construction.

717. W. McAdam, Glasgow, pottery and glass manufacturer. Improvements in the manufacture of blocks, pulleys, and weights for window sashes and other purposes, and in the mode of applying the same.

719. J. Grant, Albion-place, Maidstone, farmer. Improvements in the construction of portable railways, and in the trucks or carriages to be used thereon.

721. S. N. de la Haye de Barbezieres, Paris, barrister. An improved construction of horse shoe.

723. G. Hamilton, 6 Willow-terrace, Islington. Improvements in tumbler locks.

725. W. Pickstone, Radcliffe, Lancaster. Improvements in the manufacture of piled fabrics.

Dated March 17, 1862.

727. W. Clark, 53 Chancery-lane, engineer. Improvements in water meters. (A communication.)

731. L. P. Mongruel, 7 Rue Vivienne, Paris. An improved cold vapour generator, which may also be used in the carburation of illuminating gas.

733. G. Davies, 1 Serle-street, Lincoln's-inn, C.E. Improved apparatus for drawing. (A communication.)

737. W. Barber, Stockport. Improvements in the manufacture of hats.

739. J. M. Courtauld, Braintree, Essex, manufacturer. Improvements in power looms.

741. E. Smith, Carlisle-street, Soho, jeweller. An improvement in watch keys.

743. T. Waller, Conduit-street West, gentleman. Improvements in breech-loading fire-arms. (A communication.)

Dated March 18, 1862.

747. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. The application to the manufacture of paper pulps of a vegetable product not hitherto used for that purpose. (A communication.)

749. J. Banks, 19 Salisbury-street, Adelphi, electric engineer. Improvements in electro-magnetic telegraph printing apparatus or marking instruments, and the instruments or apparatus to be used in connection therewith.

750. H. Bailly, 5 Salter's-hall-court, Cannon-street, E.C. Improvements in the manufacture of paper from wood, and in apparatus used therein. (A communication.)

751. T. Dunn, Windsor-bridge Iron Works, Pendleton, engineer. Improvements in the construction of bridges, roofs, houses, and other structures.

753. C. Iles, Birmingham. Improvements in the manufacture of umbrellas and parasols.

755. J. A. Jaques, chemist, J. A. Fanshawe, engineer, Tottenham, and F. Jacques, Droylesdon, Lancaster, gentleman. Improvements in the construction of elastic surface rollers.

757. J. Wright, 42 Bridge-street, Blackfriars, engineer, and H. Wheatcroft, 27 Fore-street, manufacturer. Improvements in apparatus or machinery for lasting and making boots and shoes

759. F. Warner, 8 Crescent, Cripplegate. Improvements in cocks or taps.

761. J. T. Buck, New North-road, dressing case maker. Improvements in instruments and work cases known as "ladies companions."

Dated March 19, 1862.

763. R. Wilson, Patricroft, Manchester, engineer. Improvements in hydraulic presses, and in machinery or apparatus for raising or forcing fluids.

767. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in printing and painting upon glass and ceramic wares, and upon metallic and mineral substances, also in the preparation of inks and colours for printing and painting. (A communication.)

769. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in rotary engines. (A communication.)

771. J. Cumming, Edinburgh, artist. Improvements in the method of and apparatus for distributing and setting up type.

772. G. M. Todd, 81 Hackney-road. Improvements in shuttle sewing machine, and the production of a new kind of stitch.

Dated March 20, 1862.

774. J. G. T. Campbell, 1 Hatcham-terrace, Old Kent-road, clerk. Certain improvements in ships' propellers.

778. E. Field, Buckingham-street, Adelphi, consulting engineer. Improvements in apparatus for regulating the flow of gaseous and other fluids.

Dated March 21, 1862.

788. J. Humphreys, Tower-hill, engineer. Improvements in steam engines.

790. W. Phelps, manager, Nottingham, and W. R. Lymbery, Nottingham, lace maker. An improved woven fabric, and improvements in machinery for manufacturing the same.

792. W. Clark, 53 Chancery-lane, engineer. Improvements in sewing machines, which improvements are also partly applicable to other machinery for giving a rotating motion always in the same direction. (A communication.)

Dated March 22, 1862.

794. T. Marsh, West Bromwich, Stafford, hame manufacturer. An improvement or improvements in hames for horses and other draught animals.

796. E. Owen, Bala, Merioneth, North Wales, joiner. Certain improvements in the hydraulic engines known as "turbines."

798. J. Davies, Kennington, band master. Improvements in wind musical instruments.

800. F. W. Collis, Deptford, and F. Haden, Hackney. Improvements in consuming smoke, and in the apparatus connected therewith.

802. J. G. Jennings, Holland-street, Blackfriars-road. Improvements in the manufacture of biscuits.

804. T. F. Hale, Bristol, brass founder. Improvements in valves.

806. G. Hartshorne, D. G. Ward, Dudley, iron merchants, and W. Woodley, Tipton, boiler maker. Improvements in punching or perforating metal plates or sheets, and in apparatus or machinery to be employed for that purpose.

Dated March 24, 1862.

810. T. White, Birmingham, Warwick, managing clerk. Improvements in the manufacture and ornamentation of nut crackers and lobster crackers.

Dated March 25, 1861.

822. A. Fryer, Manchester, sugar refiner. Improvements in the manufacture of sugar, and in separating liquids from sugar and other substances.

824. T. Guibal, 43 Rue des Groseillers, Belgium, C.E. Improvements in the construction of ventilators, for the ventilation of mines and furnaces.

828. W. Clissold, Dodbridge Works, near Stroud, Gloucester, machine manufacturer. Improvements in carding engines.

Dated March 26, 1862.

830. L. De la Peyrouse, 13 Panton-square, manufacturer. Improvements in the preservation of animal substances.

832. J. Wilson, hotpresser and calenderer, Glasgow. Improvements in the apparatus used for and in the method of hot pressing or finishing plaids, shawls, handkerchiefs, and other woven fabrics.

831. W. J. Taylor, 5 Upper Church-street, King's-road, Chelsea. An improved method of colouring Portland cement for plain and ornamental plasterer's work on the walls of buildings and other erections.

836. R. Boby, Bury St. Edmunds, Suffolk, agricultural implement maker. Improvements in hay-making machines.

838. J. Taylor, C.E., and C. H. Minching, accountant, Manchester. A suspender or improved gallery for supporting the shades of gas or other lights.

840. R. Griffiths, 62 Mornington-road, Regent's-park, engineer. Improvements in weapons of warfare for naval purposes.

Dated March 27, 1862.

844. W. Greenway, Birmingham, manufacturer. Improvements in the manufacture of bolts for fastening doors and for other like purposes.

846. T. G. Greenstreet, 6 Penton-place, Kennington-road. Improvements in window sashes.

848. R. Edwards, Regent-street, Mile-end, emery manufacturer. Improvements in machinery or apparatus for pulverising, stamping, and washing mineral, animal, and vegetable substances.

850. J. Lock, Nassington, Northampton. Improvements in apparatus for raising or elevating straw and crops on to stacks.

854. R. De Bary, Finsbury-square, gentleman. Improvements in machinery for the manufacture of cigars. (A communication.)

856. W. E. Gedge, 11 Wellington-street, Strand. Improvements in apparatus for extinguishing fire. (A communication.)

858. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in thrashing machines. (A communication.)

860. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane. Improvements in the means of producing imitation mosaics. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

847. F. Tolhausen, C.E., 17 Montmartre, Paris. New or improved cigar tubes or apparatus for holding and smoking cigars and cigarets. (A communication.) Dated March 27, 1862.

893. J. P. Woodbury, Boston, Massachusetts. An improvement in arming war vessels. Dated March 31, 1862.

910. M. Henry, 84 Fleet-street. An improved furnace for treating iron ore. (A communication.) Dated April 1, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2955. J. Ronald. Spinning hemp.
2993. M. Ohren. Manufacture of gas.
3002. F. Spence. Treatment of ores.
3008. L. H. C. J. Carle. Indicating and registering.
3025. T. W. G. Treeby. Boring.
3030. J. Leach. Manufacture of candles.
3032. J. L. Field. Candles.
3034. W. E. Newton. Artificial teeth. (A communication.)
3037. T. Stead and W. Higham. Spinning.
3044. R. A. Brooman. Albums or books. (A communication.)
3045. A. Pullan and W. Lake. Agricultural machines.
3058. J. and W. H. Bailey. Indicating the pressure of steam and gases.
3060. J. D. Napier. Brakes. (A communication.)
3079. M. A. F. Mennons. Improved natatory apparatus. (A communication.)
3080. M. A. F. Mennons. Microscopic photographs and lenses. (A communication.)
3082. J. Fordred. Treating linseed oil.
3106. R. A. Brooman. Treating teazles or thistles. (A communication.)
3135. A. V. Newton. Hoisting apparatus. (A communication.)
3246. R. A. Brooman. Steam generators. (A communication.)
3263. T. and W. Green and R. Mathers. Giving motion to machinery.
119. E. H. C. Monckton. Applying motive power.
149. R. O. Doremus and B. L. Budd. Cartridges.
177. J. C. Johnson. Twist lace machines.
199. J. Wright. Constructing works below water.
289. T. M. Meekins. Projectiles.
340. J. Dickson. Voltaic apparatus.
387. R. Hornsby.* Separating grain.
393. J. R. McConnell. Railway breaks.
395. W. G. Valentin. Coking coal.
475. G. T. Bousfield. Elevating hay, straw, and earth. (A communication.)
510. J. Whitworth. Projectiles.
561. S. Hague. Raising hammers.
584. F. R. Houghton. Manufacture of paper.
599. J. Chubb and H. M. Burton. Exhibiting jewellery and other articles.
624. S. S Bromhead. Receptacles for coals.
682. L. Vidie. Aneroid barometers.
683. J. and R. Cunningham. Improvements in weaving.
685. G. Ermen. Receptacle or case.
700. J. Kent. Cleansing and bleaching. (A communication.
720. H. Y. D. Scott. Manufacture of cement.
722. J. Avery. Purifying coal. (A communication.)
727. W. Clark. Water meters. (A communication.)
739. J. M. Courtauld. Power looms.
769. R. A. Brooman. Rotary engines. (A communication.)
893. J. P. Woodbury. Arming war vessels.
910. M. Henry. Treating iron ore. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated April 4, 1862.

2505. J. C. Willsher.
2519. W. Simpson.
2514. R. W. Stevier.
2516. W. Smith.
2512. H. B. Coothupe and F. H. Waltham.
2531. C. W. Felt.
2533. L. Christoph, W. Hawksworth, and G. P. Harding.
2544. N. Stram.
2561. B. Taylor and C. Edkins.
2562. P. B. Houghton.
2573. P. B. Baker.
2574. T. Forster.
2584. W. Welch.
2605. H. Macmeikan.
2623. J. T. Smith.
2700. G. M. Gilbert.
2822. W. E. Newton.
2855. W. H. Balmain and J. Kean.
2877. E. Loomes.
3009. T. Ellis.
3182. W. Tate.
3202. G. T. Bousfield.
3225. F. Laurent and J. Casthelaz.
36. G. T. Bousfield.
127. N. Thompson.
191. J. Alison.

Sealed April 8, 1862.

2534. B. Browne.
2549. J. C. Ramsden.
2559. H. J. Distin.
2564. J. Flinn.
2619. H. Bloxham.
2624. E. Oldfield.
2680. B. J. Le Mothe.
2703. G. Baylise.
2743. B. Mitchell.
2784. G. T. Bousfield.
2786. H. D. Bradt.
2841. W. E. Newton.
2907. B. D. Godfrey.
3041. W. E. Newton.
3191. J. Westwood.
3221. A. V. Newton.
217. J. Hunt.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

830. A. Paget.
932. M. Coupland.
845. D. B. White.
846. E. Morewood.
850. E. Fairburn.
853. G. F. Chantrell and E. Dutch.
862. W. Owen.
873. J. T. Pitman.
881. W. Hooper.
883. W. Henderson.
889. J. H. Young.
863. J. Rogers and E. J. Tweed.
866. A. Chaplin.
933. J. Hughes, W. Williams, and G. Leyshon.
935. J. Luis.
937. W. E. Newton.
906. H. Rawson.
1124. J. Scholfield and W. Cudworth.
1096. J. Childs.

PATENT ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

736, W. Lund and W. E. Hipkins.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending April 5, 1862.

No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d	No.	Pr. s	Pr. d
2038	5	6	2128	0	3	2141	0	7	2153	0	10	2165	0	3	2177	0	3
2080	0	3	2129	0	3	2142	0	9	2154	0	3	2166	0	9	2178	0	3
2117	0	8	2130	0	9	2143	1	1	2155	0	3	2167	0	3	2179	0	9
2118	0	7	2131	0	3	2144	0	3	2156	0	6	2168	0	6	2180	0	6
2119	1	6	2132	0	10	2145	0	3	2157	0	3	2169	0	3	2181	0	3
2120	0	7	2133	0	3	2146	0	3	2158	0	3	2170	0	3	2182	0	3
2121	0	3	2134	0	3	2147	0	3	2159	0	4	2171	0	9	2183	0	4
2123	0	10	2135	0	10	2148	0	7	2160	0	3	2172	0	10	2184	0	6
2124	0	3	2137	0	3	2149	0	3	2161	0	3	2173	0	3	...	...	
2125	0	9	2138	0	3	2150	0	3	2162	0	9	2174	1	0	...	...	
2126	0	3	2139	0	7	2151	0	3	2163	0	7	2175	0	3	...	...	
2127	0	3	2140	0	3	2132	0	9	2161	0	3	2176	0	3	...	...	

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, April 10, 1862.

		£	s.	d.		£	s.	d.	nett
IRON:									
Rails in Wales and North of England	pr. ton	5	0	0	to	5	5	0	,,
Welsh Bars, in Wales	,,	5	5	0	,,	5	7	6	,,
Staf. Bars, at the Works	,,	6	10	0	,,	7	5	0	,,
,, Hoops	,,	7	10	0	,,	8	0	0	,,
,, Sheets, Singles	,,	8	0	0	,,	9	0	0	,,
,, Nail Rods	,,	6	15	0	,,	8	10	0	,,
,, Boiler Plates	,,	8	0	0	,,	8	10	0	,,
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2	11	3	,,	0	0	0	nett
Do. No. 1, Good Brands	,,	2	11	6	,,	2	15	0	,,
Scotch Bars	,,	7	5	0	,,	7	15	0	,,
Swedish Bars, in London	,,	10	10	0	,,	11	0	0	,,
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	,,	0	0	0	2
Tough Cake and Tile	pr. ton	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Australian	,,	99	0	0	,,	0	0	0	,,
South American	,,	0	0	0	,,	0	0	0	,,
Yellow Metal Sheathing	per lb.	0	0	9½	,,	0	0	0	2½
STEEL:									
Swedish Keg	pr. ton	15	0	0	,,	0	0	0	2½
,, Faggot	,,	16	0	0	,,	0	0	0	,,
TIN:									
English, Block	p. cwt.	6	1	0	,,	0	0	0	2½
,, Bar	,,	6	2	0	,,	0	0	0	,,
Foreign, Banca	,,	6	4	0	,,	0	0	0	net
,, Straits	,,	6	7	0	,,	0	0	0	,,
TINPLATES:									
Charcoal, I.C.	pr. box	1	4	6	,,	1	7	0	3
Coke, I.C.	,,	1	2	6	,,	0	0	0	,,
LEAD:									
Pig, English	pr. ton	19	15	0	,,	21	0	0	2½
,, Spanish	,,	19	0	0	,,	19	10	0	,,
Common Sheet	,,	21	10	0		22	0	0	,,
Tea ,, (Wimshurst's Patent) A special disct.	,,	35	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	10	0	,,	0	0	0	nett
For arrival	,,	18	5	0	,,	18	7	6	,,
ZINC:									
English Sheet	,,	24	0	0	,,	0	0	0	1
QUICKSILVER	pr. btl.	7	0	0	,,	0	0	0	3

JAMES LAURIE, Metal Broker.
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 18, 1862.

THE PATENT SYSTEM.

VARIOUS and most conflicting opinions on the existing Patent Laws of England have been given by men of eminent position in the country, but almost all agree that the Amendment Act of 1852 constituted an improvement upon the Statutes previously in force in relation to Patented Inventions. There are some persons, however, who are averse to patent laws of any kind, and who would deprive inventors of all legal protection. Having been originally patentees themselves, and having thereby advanced their material interests, they selfishly seek to prevent others enjoying similar advantages. With such persons, arguments, no matter how well sustained, are likely to have but little influence, and no weight. We shall not attempt the conversion of the anti-patent-law party, which, fortunately, is a very small one, but convinced that justice and common sense alike demand that the interests of inventors should be protected, shall simply at present consider the anomalies and shortcomings of the past and existing Patent systems. When an inventor agrees to make known the nature of his invention, or in other words, to make it "patent to the public," he has an undoubted right to obtain a *quid pro quo* for his pains. He has a right to demand that no other person should be allowed to take advantage of his ingenuity, or abuse the confidence he has reposed in the public. This restrictive power over his own invention the existing law allows him—on the payment of certain fees—to hold for certain terms of years, as he may determine. On the other hand, the public are entitled by the same laws to ask the inventor to publish an unreserved and unmistakable description of the peculiarities and characteristics of his invention. This is a clear matter of contract, and it should be legally observed on both sides.

On the part of inventors, there should be no attempt made by vagueness in the wording of their specifications, to compass more than the actual nature of their invention warrants. They have no moral right to urge therein indistinct claims which, by a process of torturing, may be afterwards made to invalidate the efforts of other inventors who follow them. These conditions observed, the public have no reasonable ground of complaint. On the contrary, they have every reason to be satisfied. If the invention be really a good and useful one, the public, in fact, become at once the gainers, for the inventor most probably has to sell something cheaper or better than it was to be obtained before the sealing of the patent which puts that invention into the market. Should the patent unfortunately prove worthless—and this, alas, is too often the case—nobody gains by it, and the public lose nothing, and so no harm is done, except to the patentee, who learns a lesson of caution in exchange for his fees.

With regard to the multiplicity of Registered Designs, a very large per centage of which are of little value to any one, we are not aware that any public inconvenience has arisen. If men will persist in registering their own follies and fancies at a shilling per item that is their own affair, and they are amused rather than injured by the proceeding. Just so is it with unworkable or absurd patents; and the law as it stands is a barrier, and not an inducement, to their multiplication.

As to the bargain between inventors and the public before alluded to, it appears to us that in any further revision of the Patent Laws this should be, if possible, more clearly explained. In the first place, it should be laid down as an axiom, that *the public should not be taxed for the sake of benefiting the inventor.* In the second place, it should be as distinctly maintained, that *the inventor should not be made to pay the taxes of people on account of his untried invention.* These two short and simple rules would be sufficient to govern the principles upon which would be based the mode of varying costs for "letters patent," or registration of designs. Every legitimate expense connected with the Offices of Patents or Registration, and the salaries of commissioners, clerks, librarians, &c., should unquestionably be borne by inventors. The Patent Office ought to be replete with every facility for the information of, and every means of security for, the would-be inventor. We have little faith, however, in the appointment of a Board of Scientific Commissioners, as some have recommended, for the preliminary examination of inventions. If such a board were to be formed, and it were to comprise men, the most distinguished for their mechanical, engineering, chemical, and general scientific knowledge, we do not think that satisfactory results would follow their deliberations. They would, in spite of their great ability, be frequently at fault as to the merits and demerits of schemes brought under their notice; and be quite as likely to ignore what was good and accept what was useless as to effect the converse. A Court of Law and a jury would be still the arbitrament to which litigious patentees would resort. As it is, useless inventions sink from their own density and inertness, and valuable ones swim from their possessing the opposite characteristics. So it would be were the institution of a Grand Jury of scientific *savans* to be inaugurated to-morrow. There may seem something absurd in the present arrangement—that of paying a law officer two guineas for examining into the merits of an invention and asserting it to be worthy of "letters patent," while, should the patent be eventually disputed, no assistance is given by that official in defending it from the attack. The same kind of evil would remain, nevertheless, if the Board of Examiners were to supplant the law officer. We would say, then, in presence of these facts, let the proposing patentee of any one invention have letters patent accorded him on something like the following conditions:—

1st. That he declare himself to be the first and true inventor, and that he alone is responsible for its originality and utility.

2nd. That he pay the proper fees.

3rd. That he deposit at the office a full and complete description of his invention.

To treat with disputations respecting patents, there should exist within the Patent Office a Court of Enquiry, whose mission—if the contending parties were previously willing—should be final and binding. Of course, this tribunal should be composed of men eminently qualified for their onerous offices, and above and beyond suspicion of prejudice or unfair dealing. These should be entrusted with power to set aside a Patent *nisi*. With respect to the second condition, as before stated, the costs of patenting should be regulated by the expenses of the Patent Office. The third condition is of extreme importance. We objected very much to the old law, whereby an open title was kept for six months, when the specification was put in. It is well known that this system encouraged, and was the parent of, the most nefarious practices, and although the amended law compels the applicant for a patent to describe the nature of his invention through a provisional specification, yet this is frequently complied with in so vague a manner as to be altogether nugatory. The inventor takes advantage of any further information which the six months grace affords him the opportunity of getting, and this is embodied in the final specification. The amended Act, therefore, though a decided improvement on the old law, is open to further amendment now, and occasionally, if not frequently, it opens the door to disputes, litigation, and wrong-doing. Under the arrangement above proposed, the applicant would be compelled to deposit *at once* a complete, full, and explicit description of his invention. If in the lapse of months he succeeds in making further improvements, let him provide for them by taking out a second, or third patent, for he can then afford to do so.

Such are our general views of the Patent system, which will, undoubtedly, have to undergo some modification ere long, and if they serve to enlighten members of the legislative bodies and others, at whose hands those modifications must come, we shall not consider this exposition of them to have been made in vain.

Once a further revision of the Patent Laws is determined on—or, indeed, whether revision take place or not—we would strenuously urge the erection of a more commodious Patent Office than that in which the records of patents are now "cabined, cribbed, confined." It is true that Mr. Woodcroft has done much to improve the establishment, and that he has, in fact, created order and method out of chaos and confusion. Still the Patent Office is a veritable "*multum in parvo*," in which inventors seeking for precedents can scarcely find elbow-room in the exercise of their laudable and necessary exertions.

THE *TIMES* AND SIR WILLIAM ARMSTRONG.

DAY by day the columns of the *Times* teem with articles and letters from correspondents, one of whom is Sir William Armstrong, on the question of the day, which, on the authority of the leading journal itself, is now declared to be "the most expeditious and efficient manner of "armour-plating floating structures." We did not want the sanction of the *Times* to establish this fact. For a long time past we have never ceased to assert it, but we are glad to see it proclaimed by a journal which represents the ruling powers.

In dealing with this great question, the national importance of which it is impossible to overrate, the first object is to know the truth. It would be reprehensible in the organs of public opinion to take a one-sided view of the subject, or to render the prevailing excitement instrumental to enhance the merits of one particular kind of gun in preference to any other. Still more blamable would it be to divert attention from the paramount object of preparing for the defence of our roadsteads and arsenals against the possible attack of an enemy's powerful fleet of iron-clad men-of-war, for the purpose of promoting the private interests of a clever projector and his party environed with Government patronage.

We give the *Times* credit for patriotic motives in the energetic appeals it has made to the Government and the public, in order to arouse them to a sense of a great national danger, by a series of powerful and eloquent articles, which everybody who reads them must admire. It is, therefore, with unfeigned regret, that in common with a large body of the public, we observe that the report of the late experiments at Shoeburyness, and the conclusions drawn from them by that journal, have a tendency to establish the unrivalled excellence and power of the Armstrong gun, rather than to come to a right conclusion on the best mode of constructing iron armour-plated ships, which, as the *Times* admits, is really the predominant question. Nobody doubts for a moment the necessity of our possessing the best marine artillery in the world, and it is possible that the Armstrong shunt, 156-pounder, may prove to be our model gun, and the type of that powerful class of ordnance which iron armour will call into existence; but the absorbing question the country now has to deal with is the most prompt and ready mode of converting wooden men-of-war into floating batteries. This question stands by itself, and really has nothing to do with the increased power of the Armstrong gun, except to show still more impressively that the most perfect system of armour-plating should be adopted by Government. The more powerful and destructive the guns which may form the armament of iron-clad ships, the more indispensable it becomes to construct floating batteries to resist their attacks. It is idle to suppose that other governments, if they do not already possess artillery of equal, or perhaps, superior power to the 156-pounder Armstrong, will not follow closely in our wake, and soon rival or even surpass us in producing artillery of the most formidable character, whatever may be the degree of perfection it may be brought to by Sir William Armstrong, or any other maker of great guns. It is flattering to our national vanity no doubt, to be told that we possess a class of ordnance unrivalled and unapproachable, and the *Times*, in company with Sir William, plays upon that sentiment; but the public should be plainly told that such an idea is a delusion. The principle and details of construction of the Armstrong gun are not a secret, they are known to scientific artillerists abroad as well as in this country, and there is no more difficulty in manufacturing it in France or Russia, or the United States, than in England; but it is well-known that no foreign government has attempted to adopt it, whilst more than one of them conceives that the improved rifled and smooth bore guns, which they have introduced into their service, are for practical purposes—for actual warfare—preferable to the Armstrong.

However that may be, it cannot be doubted that the nations which may any day become our enemies will sooner or later arm their iron-clad ships with guns equal to the most powerful we can construct. As to sea-going ships, they will for the purpose of attacking our harbours be able to carry one or two of the most formidable description, whatever it may be that we can put on board our iron floating batteries.

Our attention must not, then, be diverted from the pressing urgency of promptly constructing floating coast defences, because Sir W. Armstrong has produced a heavier gun than before, nor should the question of floating batteries be complicated by that of fixed forts, for which there is no need whatever at the present moment. No efforts, no expenditure would enable us to erect forts, or manufacture guns of the enormous calibre proposed in time to prevent the attack of our ports with iron-plated ships made invulnerable to the guns we now possess; and if it be admitted to be possible for us or an enemy to produce heavier guns in a short space of time, wisdom and prudence dictate that the first of these which we can manufacture, should be applied as the armament of strong and powerful floating batteries stationed in our roadsteads, or the approaches to our arsenals and dockyards. Afloat and moveable, these formidable engines of destruction will be tenfold more available and serviceable than on shore. A stone fort cannot be moved; the enemy's iron protected ships can keep out of any destructive range of the largest guns on shore, and still be able to shell our dockyards, and the shipping in our harbours, unless they be attacked at sea; but a floating battery, armed with monster guns equal in power to those of the enemy, could go out to seek the assailants, and even if far inferior in speed to the aggressor, would either bring him to action, and destroy him, or oblige him to sheer off, and so avert the danger. There can be no comparison between the two modes of defence which ought *first* to be adopted. Whatever guns on fixed forts can do, the same guns on floating batteries can do more effectually. It will be time enough to talk of advanced forts like those at Spithead, when we have made ourselves safe from immediate attack, when we know precisely how they are to be armed, and when it becomes quite clear that we want them at all, which at present is more than doubtful. Turn this question any way, for national protection the one predominant necessity, the one paramount duty of Government, is the immediate adoption of the best mode of constructing invulnerable floating batteries.

In this point of view, the late and previous experiments at Shoeburyness are most instructive, but the *Times* reporter, in his enthusiasm at the success of the pet Armstrong gun, takes no notice of the other side of the question—the nature of the iron structure against which the gun was fired. This, however, is the important part of the case. In the impartial account of the Shoeburyness experiments given by our special reporter in the last and preceding numbers of the Mechanics' Magazine, the weak points of the targets fired at were described, and it requires little mechanical skill to understand that iron plates fastened together in the rough and ready fashion of the Warrior plan could not be expected to oppose any effectual resistance to the fire of artillery. It must be manifest to any intelligent engineer that iron plates with great holes drilled through them, and with no support at the back but wood must be greatly weakened. The enthusiastic *Times* reporter informs us, "the teak "was so utterly disintegrated that it more resembled tangles of fine twine than even "the remains of woodwork." Did it not occur to him that the fair conclusion to be drawn from the "graphic description," as it is termed by Lord Clarence Paget, proved not the force of the Armstrong projectile, but the utter insignificance of wood as backing to the plates. Our report also pointed out the self-destroying effect of the through bolt, which, when struck on the head, acts as a wedge of irresistible power, splitting the iron plate in two; and the most sceptical who have witnessed the effect of the artillery on the Warrior and other perforated plates, must now be convinced that the zigzag cracks which run from bolt-hole to bolt-hole contribute more to the demolition of the armour than the positive force of the missiles. These serious and alarming defects in the Warrior system have been clearly illustrated in the letters of "A Civilian," in our columns, and have now become so patent that the attention of the authorities must be directed to the discovery of a more scientific mode of armour-plating, by the trial of other plans in a fair and liberal spirit. From the experience thus derived from actual results, it is incontrovertible that the damage done to the Warrior target like that to Thorneycroft's bars, and to Mr. Fairbairn's two targets, is due infinitely more to the imperfect nature of the structure in all those cases, than to the destroying force of the artillery employed; but even in the latter respect it is now well-known and admitted by Sir William Armstrong himself, that his 110-pounder is inferior as a battering gun at *short range* to the 68-pounder.

No person who has witnessed and examined the effect of the projectiles from both guns on iron plates can entertain a doubt on that point. In the controversy of guns and armour plates, Sir W. Armstrong is a partizan and advocate in his own cause. His letter is a cautious and well-constructed piece of special pleading. His arguments are one-sided—every point in favour of the gun is made the most of, but the nature of the iron structure is kept out of sight; its weak points are ignored, and, if alluded to, are mentioned so vaguely as to convey no idea of their full capability of resistance. The nature of the structure to be demolished by the projectiles discharged against it is, however, the main consideration, for the effect of the projectile, whatever its force must be measured by the resistance it has to overcome. The positive force of every projectile at a given range is a known quantity. We don't want Sir W. Armstrong's calculations to give us that information. What we want to know is the strength of the structure to the demolition of which the projectile force is to be applied. On this, the most important branch of the question, we are, so far as practical comparative experiment goes, completely in the dark. The Admiralty, blindly confident in the absolute perfection of the Warrior armour, afforded no facilities for trials of other systems, so that we have to enter upon a new era of experimental target practice to repair the blunders that have been committed. No more good, however, will result from a series of new trials than from those which have been carried on the last two years, unless they be conducted by an independent and properly constituted commission.

GOOD IRON, AND HOW TO GET IT.

It has been seen, from a previous article on this subject, that there are several reasons for the deterioration in the quality of iron, of which all who have to deal with it complain. Still there is no doubt that good iron exists, and the vital question is, "How to get it?" The writer of the pamphlet to which reference was last week made in our columns, has something to say upon this subject, and what he says is worth the listening to. "The prevailing notion that all iron alike is improved by "manipulation, is doubtless derived from the "traditions of the old time, when all iron was "produced by cold blast, and it has survived "the state of things which still made it true. "In the present condition of the manufacture, "it has led to ruinous mistakes. Inferior iron "very soon attains the point after which it "loses by being again subjected to the action "of the fire, and by the time it has reached "the stage of 'merchant bar,' it cannot be "worked with further advantage. Here, then, "is an easy practical rule for the manufacturer's "guidance. When he needs iron for any "purpose that implies repeated workings of "the metal, he only prepares disappointment "for himself or his customers if he is induced "to employ any but the best quality."

It is impossible to dispute this position, and practical ironfounders and others will acknowledge its truth. The perplexities which beset the manufacturer in pursuit of the best iron have indeed become proverbial, and they were enforced with considerable perspicuity by a member of the Association of Foremen Engineers, at a meeting of that body held the other day. Perhaps the question, "How to "obtain the best iron?" is, at this moment, of more *vital* importance to the Government than to any private individual. Indeed, it is a national question; for notwithstanding the remarkable results effected at Shoeburyness last week, there is no doubt whatever that armour-plated ships, of one description or another, must be our safeguard from invasion, and the defences of our colonial possessions.

The reconstruction of the British navy is, in fact, "on the cards," and whether as regards prows for running down the enemy's ships, plates for withstanding the impact of heavy projectiles, or the knees and beams for strengthening the entire structure of ships of war, the best iron is a desideratum, nay, an indispensable requirement. In thus speaking of the best iron, we refer to that which combines in a judicious degree hardness with toughness. The last named qualification, it is generally agreed by practical and scientific men, is the one most essential for armour plates, and what are known as "puddled bars," are certainly therefore the only reliant material for producing such plates. "Scrap iron," on the contrary, is well calculated for giving hardness. Much misapprehension, however, exists as to the use of "scrap," and to this point the writer of the pamphlet before us addresses himself. Amongst practical men scrap iron is regarded with much favour, and in forming the castings employed in the construction of the new Westminster-bridge, it was largely incorporated. "The term 'scrap,' however," says our author, "has reference to form only, and it must not be assumed that fragments of good iron and fragments of bad are equalised in quality, because they are identified in name. . . . . . If under the name of scrap-iron are swept off the miscellaneous contents of marine stores, of unknown quality, varying from the very best to the very worst, of unequal sizes, and coming to the welding point at different temperatures; and above all, if 'old rails' are smuggled under another name, the question between scrap-iron and puddled bars is no longer one of manipulation only, but also of quality." It will be well, then, for the advocates of scrap to look to the doubtful nature of the material upon which they base their faith. Two blacks never make a white, and out of two or more elements of weakness, it is scarcely wise to hope for the elicitation of strength. The difficulty of testing scrap iron is almost insurmountable, and so is that of obtaining it good or bad, in sufficiently large quantities to meet the demand. It is pretty clear then that to other sources must the manufacturer look for good iron. Many experiments have been tried at our arsenals with a view to answering the query which forms the title to this article, and at Woolwich especially the greatest amount of care possible has been exercised, we know, in obtaining truthful results. The blue book published by the authorities there, or for them rather, bears eloquent testimony to this fact, and when Sir William Armstrong's appointment took place, and dislocated things as they were, there is no doubt that Colonel Wilmot and his coadjutors were on the very threshold of further discoveries in relation to the mixtures of iron. It would be well were the experiments then interrupted resumed. The 68-pounder guns turned out at Woolwich Arsenal during Colonel Wilmot's *regime* were by no means the despisable weapons which some have asserted them to have been; and, indeed, the material of which many of the most recently cast were composed of iron admirably mixed, and possessing all that tensile and transverse strength obtainable by scientific admixtures of metal.

The writer of the pamphlet under notice is anxious, too, that an experiment, which, he asserts, is as yet untried, should be forthwith carried out at Portsmouth, or some other place where equal facilities exist. It is that of "ascertaining the strength of armour plates made entirely of puddled bars. To effect this it is only necessary to secure puddled bars of the best quality, and on this point there is no fear of being deceived. However difficult it may be to *make* the best puddled bars, the process by which they are tried is simple. It is merely requisite to strike them, *both when red-hot and when cold*, with a heavy hammer, so as to bend the extremities. Iron destined to make plates should stand both these tests, not because an armour plate will ever become red-hot 'under fire,' but because, if not of a quality to be pliable when heated, it will not retain its toughness throughout its subsequent workings in its conversion."

Here is a practical suggestion which it may be worth while for the Admiralty to attend to, and which if acted upon may lead to correlative advantages. It would enable the Government, in fact, to judge as to the propriety of making its own ship armour plates in preference to trusting so much to contractors and others for their supply. These latter have not been able to furnish plates of uniformly good character as yet, and an attempt on the part of the State to manufacture them for itself, might have the effect of inducing contractors to exert themselves more strenuously. Under any circumstances, the State would not suffer from the experimentation.

We cannot do better than conclude this subject for the present by a quotation from the pamphlet before us. Speaking of the use of iron for the purposes of warlike attack and defence, it says:—"Instead of pouring into our docks and arsenals a steady supply of impenetrable (or, as we should substitute, 'uniformly good') ship and armour plates, we are disputing about what is good iron, and are struggling to use what is not. Nevertheless, the impulsion is given—ill or well the movement will go on—our wooden walls are rapidly being transformed into iron. The cost will be enormous. It depends on the direction for good or ill now given to the iron manufacture whether the expenditure be not made in vain."

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER VIII.

Influenced by the intense interest felt by everybody in the actual battles of iron-cased ships, I was led in my last letter to take part in the topic of the day, and for a time I suspended the consideration of the construction of iron armour. But I resume this subject, which is of more practical importance than before, as the prompt application of the best system of armour plating has become a State necessity. The debates in Parliament and the recent experiments at Shoeburyness have fixed the attention of the country on the question of invulnerable naval structures, and the authorities are obliged to enter into it with the energy and good faith it demands.

Several plans of ingenious inventors, addressed to the Mechanics' Magazine, having been submitted to me, I have selected one, the invention of Mr. W. H. Taylor, of Hartlepool, which is described in another part of this Journal, and appears to be deserving of notice.

Mr. Taylor complains that I do not propose any new plan, and he offers one of his own, thinking that mode of proceeding more useful and more patriotic than declaiming against inefficient plans; and so it might be if his were superior, on which I shall have a word to say; but Mr. Taylor and your other readers must bear in mind that Government having adopted an inferior plan, which it has applied to a number of ships at an expense of millions, and persisting in that plan to the exclusion of all others, I made it my special object to open the eyes of the people and of the Legislature to the folly and danger of the course pursued, as well as to the reckless waste of the national resources. What happened in Hampton Roads, I foreshadowed months before as an event which any day might happen in the Medway or the Solent. My letters, I have reason to know from numerous communications to the Mechanics' Magazine, produced a good effect—they stimulated the ingenuity of inventors, and attracted the notice of influential persons to a subject little understood. But the battle of iron-sides did more in one day to arouse the nation to a sense of its great peril than my feeble efforts could ever have accomplished. Still, however, the practical part of the business has to be carried out, and will receive at my hands the earnest attention it deserves.

Mr. Taylor, I think, has no right to complain; for he acknowledges my letters aroused in him the inventive faculty which gave birth to the plan under consideration. Mr. Taylor's armour plates are narrow bars of iron, all of the same width and sectional form, fitting into and overlapping each other at the edges longitudinally, on the dovetail principle, with a convex surface (*a*, *c*) on one face, and a flat surface with flanges (*b*, *d*), on the other face. There is an under and upper set of bars; the flanges of the under set (*d*) are fastened to the skin plate of the ship with tap screw bolts, passed through from the inside, screwed into the flanges (*d*) at one end, and secured with nuts inside the skin plate at the other end. The flanges (*b*) of the upper set of bars cover the convex heads (*c*) of the under bars, and form joints over them. Mr. Plum adopts the same form of longitudinal dovetailed bar, with a convex or flat head and flanges; but he uses this bar as a rib to hold and fasten by the edges plates of much greater width than the ribs, the edges of the plates fitting into the dovetails of the ribs; and Mr. Plum, instead of tapping bolts into the flanges, as fastenings, passes bolts with heads through the flanges, securing the ends of the bolts with nuts, as in the other case. The object of using large plates is to diminish the number of joints at the surface, these being considered a source of weakness; and I believe, on this plan, they are so, because the overlapping edges of the dovetail can never be made to fit so closely to the edges of the plates they hold as not to leave interstices between the two iron surfaces, which we know, from experiments with Thorneycroft bars, and the tongued and grooved edges of the Warrior plates, are infallibly the cause of the edges being ripped open, and detached from the body of the plate.

On this principle, the plans which are of the nature of a frame fastening, holding the edges of plates, would seem to be condemned. Having, in a former letter (No. 2, Fig. 11), which described Mr. Scott Russell's plan, expressed my opinion on that point, it is unnecessary to repeat it here. Of course, the narrower the plates, the more this cause of damage is multiplied.

In Mr. Taylor's system, the ribs which carry the bolt fastening are not exposed to the immediate impact of projectiles, the flanges of the outside bars covering the top of the inside bars, but these flanges are so thin, and the contact of the iron surfaces would be so imperfect, tha they would be liable to be torn off by the blows of projectiles. The shock, moreover, on the upper plates would be transmitted to the tapped bolts, and probably break them off at the joint of the nuts and the skins, as was the case with the tapped iron fastenings of Mr. Fairbairn's first target, described in letter No. 2, Fig. 8. If Mr. Taylor had witnessed the effects of trials with targets constructed on plans analogous to his own, he would require no explanations to convince him that the objections stated have some good foundation. As to the thickness of plates, there is a limit imposed by the weight which a ship is capable of carrying. A vessel of the construction and tonnage of the Warrier is calculated to carry a weight of armour equal to six and a-half inches in thickness of iron plates. She could not bear a heavier load.

Mr. Taylor conceives that by his method a greater thickness of armour plates might be attached to a ship, but the same end may be readily attained in other ways. There is, as we have shown, a limit to the weight, and consequently to the thickness of armour plates for floating structures which cannot be exceeded.

Having expressed my opinion freely on Mr. Taylor's as on other plans, I beg to remind the inventors that the objections I have raised are not founded on theories I have conceived, but on the results of actual experiments.

At the same time, I admit that the circumstances under which many trials have been made have been so unsatisfactory for inventors, and sometimes so unfavourable to the defence and so favourable to the attack, that the experiments referred to are not data of sufficient authority to determine the merits of every plan. With reference to Mr. Taylor's system, it comprises some points so apparently advantageous that it ought to be submitted to a fair trial. Some of the objections I have stated might be obviated. No invention is perfect when it first issues from the brain of the inventor. Sir William Armstrong, for instance, has modified almost every detail of his plan of constructing ordnance, and it is only by an unlimited expenditure from the public purse he has been enabled to accomplish what he has done, and yet it is believed by competent judges that other systems of artillery are preferable to his.

At this national emergency, when the most perfect mode of armour plating is the grand desideratum, the Admiralty ought to apply a part of the £40,000 at its disposal for experiments to the trial of inventions of promise, and Mr. Taylor's appears to be one of the number.

A Civilian.

ECONOMIC APPLICATION OF SEA-WEED.

At a recent meeting of the Society of Arts, Mr. Edward C. C. Stanford, F.C.S., read a very admirable paper on the practical applications of sea-weeds to the purposes of daily life. The first application of sea-weeds was made during the last century, when they were burnt as a source of carbonate of soda, this employment of them was for a time almost superseded by the process of obtaining soda from common salt, but the recent demand for iodine has rendered the production of kelp, or the ashes of sea-weeds, again remunerative.

At present the principal economic applications of sea-weed are furnishing food, medicine, manure, and the manufacture of kelp.

Many of the algæ are found to possess nutritious properties, dependent on the presence of a peculiar gum, starch, sugar, a small portion of vegetable albumen, and a considerable proportion of nitrogenous tissues.

Tangle, or sea girdles (*Laminaria digitata*), is occasionally eaten when young. The stems moreover make excellent handles for knives, files &c., for if the tang of the blade is inserted into the freshly cut stem, the latter contracts as it dies, holding the blade with very great firmness, and presenting a wrinkled appearance very like buck horn. Moreover, it is very durable, especially if varnished, and is worthy of a much more general adoption.

The common Bladder wrack (*Fucus vesiculosus*), may be used, after being boiled, as a food for hogs; it is dried and employed in the Western Hebrides as a food for cattle and sheep. Laver (*Porphyra laciniata*), after having been pickled with salt, is constantly sold in London as an article of luxury, the market being chiefly supplied from Devonshire.

Dalse or dillisk (*Rhodomenia palmata*) was formerly chewed instead of tobacco in Ireland and Scotland, and is a favourite ingredient in ragouts in the islands of the Archipelago.

Carrageen or Irish moss (*Chondrus crispus* and *mamillosus*) are largely used in England as affording nutritive jellies. The chief supply comes from the county of Clare. These plants are remarkable as containing nearly 80 per cent. of a peculiar gelatinous principle, which differs from ordinary gum in not being precipitated by alcohol; from gelatine, by not being affected by tannin; and from starch, by giving no blue colour with iodine. The plant is largely employed in pulmonary complaints. In Ireland it is used as a substitute for size; and in England for making bandoline or fixature for the hair.

One of the most remarkable of the plants, is the sea-weed from Java, known as *Gelideum comeum*; it is used as a material for an iced jelly in Java, and has been found to contain nearly one-third of its weight of a peculiar principle termed gelose, that possesses ten times the gelatinizing power of the best isinglass, this principle closely resembles that which exists in the carrageen.

Ceylon Moss, as it is commercially known, is the *Plocaria candida*. It contains the same principle in large proportion. It is collected very largely in the Indian Archipelego; its price upon the spot being from 5s. 8d. to 7s. 6d. per cwt. It is largely used for food, and is employed as the best material for varnishing Chinese lanterns; and it is supposed to be the substance from which the swallows construct the celebrated edible birds' nests. Mr. Stamford considered the value of algæ as food was very much underrated in England, and that as material for cattle food they offered great advantages, being economical and nutritive.

As manure, the algæ are most appreciated in the Channel Islands, where the "vraic" is in constant employment, being either spread and ploughed in fresh, or dried and burnt as fuel, the ashes selling as manure for 6d. per bushel. It is estimated that about 30,000 loads of vraic are obtained annually from the shores of Guernsey, the value being 2s. per, load or £3,000, and the amount gathered at Jersey is probably equal.

In Ireland drift weed is largely used as a manure for the potato crop, and the residual sea-weed ash from the iodine factories in France, is valued for the same purpose, and carried many miles from the factories. The produce of the Isle of Thanet in Kent is said to have been tripled by the use of sea-weed as manure, and farms on the Lothian coasts let for 20s. to 30s. more rent per acre when the tenants have a right to the sea coast where the weed is thrown ashore. There can be no question that in England the value of sea-weed manure is not duly estimated.

See-weeds have been proposed as materials for paper, but their cellular character and the total absence of woody fibre forbids much hope of them being employed with any great benefit.

Kelp, or the ash of burnt sea-weed, is the only commercial source of iodine; its production is now limited to a few parts of Great Britain, the Western and Northern Islands of Scotland, the north-western coast of Ireland and Guernsey; the sea-weed ash of the latter locality is the richest in iodine, a low heat being employed in its production, and the *Laminaria digitata* being the weed burnt. The average yield of British kelp may be taken at 10,000 tons, at £4 per ton, giving an annual income of £40,000. This amount represents about 200,000 tons of fresh weed, a very insignificant amount when compared with that annually thrown upon our coasts and allowed to decay uselessly. Iodine is obtained from kelp by liviating it in water, separating certain salts by cystallization, adding sulphuric acid to decompose the sulphides present, and distilling the residue with binoxide of manganese, when the free iodine sublimes.

The author of the paper suggests the following important improvements in kelp burning, as at present practiced.

The lowering of the temperature in burning; as at present the loss of iodine by volatilization is equal to the amount gained; and the decomposition of the sulphates by the heated carbon gives rise to the formation of sulphides, which require a considerable quantity of oil of vitriol for their decomposition.

The more careful separation of the ash from the clay, sand and stones of the pits,—and the preservation of the weeds thrown up in winter, as they are the richest in iodine.

Dr. Wallace suggests that the better plan would be to char the weeds rather than to burn them, but the difficulty of charring on the sea coast and the greater cost of carriage of the more bulky charred mass is considerable.

Distilled in cast iron retorts, sea-weeds yield several valuable products. An inflammable gas, a watery fluid containing salts of ammonia, and also naptha, a fluid tar and a light charcoal, all these products are of considerable commercial value, but the question remains as to whether they are yielded in sufficient quantity to render the manufacture remunerative. Taking the common *Fucus Vesiculosus*, as an example, one ton of dry weed yields of charcoal 7 cwt 68 lbs., tar 86 lbs., watery fluid 72 galls., gas about 1,000 cubic feet.

From the watery portion and the tar are obtained 850 ounces of volatile oils, resembling the mineral hydrocarbons, 220 ounces of naptha, 62 lbs. of sulphide of ammonia, 18 lbs. of acetate of lime, and some colouring.

The charcoal remaining in the retort consists of about 3½ cwt. of pure carbon, 72 of chloride of potassium, 1 cwt. 71 lbs. of common salt, 1 cwt. of insoluble ash, and 0·2 of a pound of iodine.

It is obvious, therefore, that by a different mode of burning many of these valuable products which are now entirely lost may be utilized. The present mode of manufacturing kelp is a very wasteful one, as these valuable products are all volatilized away.

Mr. Stamford sums up the improvements he suggests in the following heads:—

1. Sea-weeds of all kinds are to be stored in sheds; they keep perfectly well under cover; they should be first collected in heaps, to drain off the superficial water, and then laid out in drying sheds; in summer, advantage may be taken of the sun's rays. Sea-weeds, when laid out thin, are not so difficult to dry as is generally supposed, and when dry keep perfectly well under cover.

2. The sea-weeds thus dried are then to be compressed into cakes, by hydraulic or other pressure; this is not essential, but the cakes occupy less room in stowage, and if the charcoal obtained is to be used for fuel, this treatment improves it.

3. The cakes, or the unpressed weed, are then to be distilled at a low red heat, in close retorts; the tar and aqueous products to be collected in suitable condensers, and the gas in a gasometer. The gas may be employed for heating the stills used for rectifying the products, for heating the drying sheds, or even for lighting the factory; it might even be treated according to Pettenkofer's method of superheating, and used as a means of lighting a district. The best kind of retort for the purpose will, I think, be cylindrical vessels of wrought iron, heated externally, and placed vertically, having the base and also the upper end conical; the former furnished with an air-tig

ron damper plate, for withdrawing the charge when the carbonization is complete, and the latter provided with a moveable iron hopper for introducing the charge.

4. The charcoal is to be lixiviated and treated as ordinary kelp, and then thrown out in heaps to dry in the air. When raked from the retorts it should be allowed to fall into the lixiviating water, or into iron boxes, to protect it from the air; if the latter plan be adopted their heat may be rendered available for drying the weeds by wheeling them into the drying shed. The lixiviation will require larger tanks for its conduction than those at present employed, on account of the greater bulk of the charcoal; it has the advantage, however, of floating on water, and as the water in contact with it, when saturated, sinks to the bottom, it is quickly replaced by a fresh portion, and the solution is thus rapidly effected. The solution would be roughly evaporated to dryness, and the salt thus obtained sold to the lixiviator.

5. The washed and air-dried charcoal is to be used for heating the retorts and evaporating the solutions of the salts. Should, however, peat be very abundant in the neighbourhood this charcoal may be manufactured into manure, by treating it with the ammoniacal liquid; or be applied to some of the many uses for charcoal, and the peat employed as the fuel. The ash from the charcoal is a valuable manure; it usually contains over 20 per cent. of earthy phosphates.

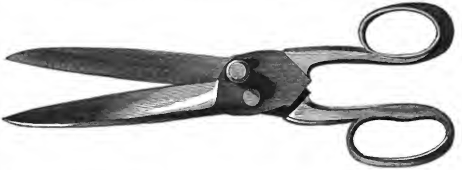
6. The products of distillation I recommend to be treated as follows:—The tar is syphoned off, and distilled with an equal measure of water in an iron tar still; the light volatile oil passes over with the water, it is decanted, and treated with dilute sulphuric acid, which removes picoline and other oily bases, and the red colouring matter is deposited. This substance is washed and dissolved in spirit, and the solution deposits it on evaporation. The light oil is then agitated with from 5 to 10 per cent. of oil of vitriol, washed with water and caustic soda, and finally re-distilled. The residual tar, is then pumped into another iron still, and a stronger heat applied. The paraffin oil is thus obtained, and purified. The residual pitch may be employed for the manufacture of patent fuel, &c., or subjected to a red heat, by which a further portion of paraffin oil is obtained, and a good coke left in the still, valuable on account of its freedom from sulphur. The liquid in the condensers, is mixed with lime, and distilled. Ammonia and naptha pass over. The solution of acetate of lime remaining in the still is evaporated to dryness, and the impure acetate thus obtained purified. The ammoniacal distillate neutralised by hydrochloric acid is re-distilled by the agency of steam, yielding naptha; the solution of chloride of ammonium remaining in the still is run out, and crystallised.

This, then, is the process, and it offers the following advantages:—

1. Retention of the whole of the iodine.
2. Easy and rapid lixiviation, colourless solutions and pure salts.
3. Absence of sulphur compounds in the mother liquor, great saving of oil of vitriol, and no evolution of poisonous gases.
4. Factory to a great extent self-supporting, having its own means of heat and light, the fuel being extracted from the weed itself.
5. Manufacture continuous, affording employment to the kelpers all the year round, and at a higher rate of remuneration.
6. Extension of the manufacture, as this process allows a much larger margin for profit, and admits of the lucrative working of the commonest weeds, which will not, I anticipate, be allowed to rot on the shores of Great Britain when their commercial value becomes known.

Commander Bedford Pim, in a letter to us, says:—Reverting to your impression of the 21st ult., I wish to inform you that I have no claim to the merit of inventing the method of joining iron plates shewn in Fig. 20. The originator of the idea is Mr. George Fawcus, dockowner and shipbuilder, North Shields.

MITCHELL AND BRUNTON'S DRAW-CUTTING SHEARS.



There are but few instruments of general use which have been so little improved as the common shears, whether in their most general form of scissors, or arranged for use in cutting metals, &c. Hitherto they have consisted essentially of a couple of cutting blades pressed gradually together by mere force, and all improvements in them have been designed either simply to temper and improve these blades, or to adapt the shears for cutting various substances. Recently, however, a very valuable improvement in all such instruments has been effected by Messrs. Mitchell and Brunton, of Greenwich, the former of whom is a master tailor and the latter an engineer. This improvement, although of an exceedingly simple character, has given to shears a degree of cutting power far greater than was ever before attained, and is equally applicable to them for whatever purpose they may be employed. It consists in placing the centre or pin upon which the blades turn in an eccentric position, or on one side of the point towards which the edges tend when open, as illustrated in the accompanying wood engraving. The effect of this improvement, (which has been patented), is to cause the blades in closing to move past each other with a "draw-cutting" action, by virtue of which they will pass readily through a thickness of material upon which the blades of ordinary shears would be vainly compressed. We have tried the improved shears upon several thicknesses of cloth, and have been suprised at the great difference in the action which this change has effected; and we have no doubt that in shearing metals the same advantage will be gained.

ON THE CORROSION OF ZINC-COVERED OR "GALVANIZED" PIPES, WHEN USED FOR CONDUCTING WATER.

By A. A. Hayes, M.D.

Iron pipes covered with a firmly-adhering surface of zinc more or less pure, have been used as conduit pipes, under the received supposition that the zinc, by its polarising action from contact, will preserve the iron from corrosion, in the act of itself suffering oxidation. As the oxide of zinc, formed under some circumstances, adheres to the metal and encrusts it with a body not soluble in water, it has been assumed that water, passing through such pipes, would not become contaminated by either iron or zinc oxide.

Some months since, I analysed some well-water, which had produced a white deposit in the culinary vessels in which it had been boiled, and was itself turbid. The deposit proved to be oxides of zinc and iron with organic matter, and the water held suspended and dissolved organic salts of both these metals. On learning the fact that the pipes had not been long in use, a request was made that suitable precautions should be taken to avoid using the water in preparing food; and by ensuring a large flow of water through the pipes continued for several weeks, the possible formation of a protecting surface was expected. But after long exposure in this way to much water drawn from the well, analyses of the water in the pipe and that in the well did not indicate any diminished action on both the metals. The zinc exposed to this water not only dissolved in it, but lost its usually observed power of protecting the less oxidisable metal in contact with it, and the quantity of salts formed from both metals was so large as to render it unfit for general domestic use.

Some weeks later, I received a sample of water from a more distant town, the purity of which was suspected, and this was found to contain organic salts of zinc and iron also, although colourless and transparent. In this case the galvanised pipe had been longer exposed, and symptoms of anomalous disease in the family consuming the water, led to the chemical trials. The acid present in both salts appeared to be the crenic, and, in one case, traces of ammonia were found, constituting a compound salt. When the water was boiled, especially in metallic vessels, a white deposit of oxides of zinc and iron, with altered organic matter, appeared, but long-continued ebullition was required to ensure complete decomposition of the salts.

The observed loss of protection in this exposure was deemed a point of much interest, for I had repeatedly examined iron boilers protected from corrosion by zinc surfaces, and have recommended this resort in numerous cases within the last thirty years, under varied circumstances, where the protection seemed to be nearly complete.

Mentioning these facts to my friend, Dr. Samuel, L. Dana, of Lowell, he informed me that zinc surfaces failed to protect iron surfaces exposed to the flowing water of the Merrimac River, and showed me the result of such trials; the iron being much corroded both near by, and remote from the protecting metal.

As the kinds of well-water which acted on the zinc and iron in these cases are quite common in every part of New England; it seems doubtful, in a sanitary point of view, if such pipes are proper for conducting water generally; for, even when care is exercised, the metals dissolved in the water will surely be found in the food partaken of by families thus supplied.

I am aware that many persons consider both zinc and iron compounds, when taken into the system, as not actively poisonous, if even harmful; compounds of iron, especially, being found in the system. The chemical fact of the most importance in this connection is, that the compounds of iron naturally found in the system are derived from compounds of iron existing in the food by the simplest transformation, and that other forms of combination will not supply these, and are active extraneous bodies, which leave their marks on the stomach tissues.

In illustration of the activity of an iron salt when the dose is very minute, the effects of chalybeate waters may be instanced, and there are few medical men who have not not witnessed the most surprising changes in the system induced by these, even when the ordinary preparations of iron have failed in their action. Now, in most of the ferruginous waters, it is the crenate of the protoxide of iron which occurs—the same salt which the galvanised pipes produce,—while the zinc is not found as the well-known oxide, but in the state of an active salt corresponding to the iron compound, and has no claim to consideration as a body forming healthy secretions.

METEOROLOGICAL TELEGRAPHY.[*]

The telegraphic communication of meteorological changes from distant stations to a central position, whence occasional warnings of impending storms might be given, which has been organised and tried by Government, had its origin at a meeting of the British Association, in 1859, at Aberdeen, under the presidency of that deeply-lamented Prince whose short life was wholly devoted to the most useful objects. It was then resolved by the council that application should be made to Her Majesty's Government for an organisation and trial of a plan by which the approach of storms might be telegraphed to distant localities. At two meetings in Buckingham Palace, early the following year (1860), minutes were authorised on this subject, and correspondence ensued which resulted in establishing a telegraphic communication of meteorological facts between twenty home stations, besides foreign ones, and daily with Paris.

The Aberdeen meeting had only just terminated when public attention was startled by the loss of the Royal Charter. It so happened that the storm which caused the destruction of that iron ship (notwithstanding power of steam additional to that of sails, and while a sailing ship, managed differently, was bearing its brunt uninjured within a few miles distant[†])—that storm, completely cyclonic, passed over the middle of England, and could be more fully investigated than any storm hitherto, because in every direction observers happened to be ready, who recorded ample statical facts, and many valuable dynamical results.

Advancing gradually, the first cautionary or storm-warning signals were made early in 1861, but on that occasion were unhappily disregarded in the Tyne, and on the following days awful losses of life were witnessed on the north-east coasts. From that time to the present similar warnings have been given there and elsewhere—with increasingly advantageous effects it appears—if one may judge, in the first instance, by applications since sent officially from all the principal ports, and from the chief associations of Underwriters, in addition to Admiralty approval, and the co-operation of the coast-guard.

In August, 1861, the first published "forecasts" of weather were tried; and after another half-year had elapsed for gaining experience by varied tentative arrangements, the present system was established. Twenty reports are now received each morning (except Sundays), and ten each afternoon, besides five from the Continent. Double forecasts (two days in advance) are published with the full tables (on which they chiefly depend), and are sent to six daily papers, to one weekly, to Lloyds', to the Admiralty, and to the Horse Guards, besides the Board of Trade.

These forecasts add almost nothing to the pecuniary expense of the system—while their usefulness practically is said to be more and more recognised.[‡] Warnings of storms arise out of them; and (scarcely enough considered) the satisfaction of knowing that no very bad weather is imminent may be very great to a person about to cross the sea. Thus their negative evidence may be actually little less valuable than the positive.

Prophecies or predictions they are not; the term forecast is strictly applicable to such an opinion as is the result of a scientific combination and calculation, liable to be occasionally, though rarely, marred by an unexpected "downrush"[¶] of southerly wind, or by a rapid electrical action not yet sufficiently indicated to our extremely limited sight and feeling. We shall know more and more by degrees. At present it is satisfactory to know that the measures practised daily in these proceedings do not depend solely on one individual. They are the results of facts exactly recorded, and deductions from their consideration, for which rules have been given. An assistant has been practised, and is able to share their responsibility. Others are also advancing in the subject of dynamical meteorology.

Air currents sometimes flow side by side, though in opposite directions, as "parallel streams," for hundreds or even thousands of miles. Sometimes they are more or less superposed—occasionally, indeed frequently, crossing at various angles, sometimes combining, and by the composition of their forces and qualities causing those varieties of weather that are experienced as the wind veers more toward or from the equator or the nearest pole, and sometimes so antagonistic in their angular collision as to cause those large circling eddies or rotatory storms called cyclones (in modern parlance), which are really like the greater storms in all parts of the world, although they do not quite assimilate to those local whirlwinds, dust-storms, and other commotions of atmosphere, which seem to be more electrical in their characteristics, if not in their origin.

Whenever a polar current prevails at any place, or is approaching, the air becomes heavy, and the barometer is high or rises. When the opposite (equatorial or tropical) prevails or approaches, the mercury is low or falls, because the air is, or is becoming, specifically lighter, and these changes take place slowly.

Whenever, from any causes—electrical, chemical, or simply mechanical—either current, or any combination of currents, ceases to press onward without being opposed, a gradual lightening of the atmosphere, through a greater or less area of hundreds, or perhaps thousands of miles occurs, not suddenly, but very gradually, and the barometer falls. There is less tension.

To restore equilibrium, the nearest disposable body of air (so to speak), or most moveable, advances first; but an impulse, at the same time, may be given to other and greater masses that, though later in arriving, may be stronger, last longer, and cause greater pressure mechanically as well as by combination. Air, like water, mingles very slowly, either from above or laterally.

Taking, with Dové, north-east and south-west (true) as the "wind-poles," all intermediate directions are found to be more or less assimilated to the characteristics of those extremes; while all the variations of pressure, or tension, many of those caused by temperature, and all varieties of winds, may be clearly and directly traced to the operations of two constant principal currents—equatorial or tropical, and polar—our north-east and south-west.

Great distinction should be marked between those ever alternate and often conflicting main currents—tropical and polar, and the local effects of their union, or antagonism, namely mixed winds—whether westerly or easterly, with occasional cyclones or circulating eddies, on a large or small scale.

Considering that the lower current does not ordinarily extend far upward (only a few thousand yards, or even feet), and that high land, mountains, especially ranges of mountains, alter and impede its progress, a variety of eddy winds, or as it were streams of wind, with local and apparently anomalous effects, must be frequently caused.

Electrical action, condensation of vapour into hail, snow, rain, or fog, causing heat; or its other changes, namely evaporation, rarefaction, and expansion—absorbing heat, and therefore causing cold—immediately affect currents of air in a degree proportional to such influence; inducing horizontal motion.

The polar current always advances from the polar quarter, while laterally moving eastward (like a ship making lee-way), being pressed towards the east by the tropical flow which advances from the south-westward, usually above and at an angle with the polar stream or current of air, often mixing with it, but at times separately penetrating downward, then sweeping and warming the earth's surface, uncombined with the polar current, even while feeling its approaching influence: and thus, as it were, forcing passages between streams of chilling polar air that at the same time are moving in opposite and nearly parallel directions.

Sometimes their opposition is so equal, and equilibrium is so complete, that a calm is the result, no sensible movement horizontally along the earth's surface being perceptible.

Self-registering barometers show the alterations in tension, or, so to speak, the pulsations, on a large scale, of atmosphere, by hourly marks; and the diagram expresses to a practised observer what the "indicator card" of a steam cylinder shows to a skilful engineer, or a stethoscope to a physician.

Our own Islands have very peculiar facilities for meteorological communication, by telegraph, between outlying stations on the sea coast and a central place—all being at nearly the same level, and nearly all comparatively uninfluenced by mountain ranges.

And now, the results are, that, having daily knowledge of weather (including ordinary facts of a meteorological nature), at the extreme limits and centre of our British Islands, we are warned of any great change taking place; the greater atmospherical changes being measured by days, rather than by hours. Only local changes, however violent they may be occasionally (and dangerous in proportion to their suddenness and violence)—only such changes are unfelt at a distance, and do not influence great breadths—say, hundreds of miles in area—of atmosphere.

Extensive changes, showing differences of pressure, above or below the normal or mean level, amounting to an inch or thereabouts, are certain to be followed by a marked commotion of the elements in the course of a few days. If the fall has been sudden, or the rise very rapid, swift, but brief, will be the resulting elementary movement; if slow, or gradual, time will elapse before the change, and the altered state of weather will take place more gradually, but last longer.

Notice may thus be obtained, and given, a few hours or a day, or even some days, before any important change in the weather actually occurs.

Having such knowledge, it obviously follows that telegraphic warning may be sent in any direction reached by the wires, and that occasionally, on the occurrence of very ominous signs, barometric and other—including always those of the heavens—such cautions may be given before storms as will tend to diminish the risks and loss of life so frequent on our exposed and tempestuous shores.

It has been proved also, lately, that storms, indeed all the greater circulations of atmosphere between the topics and polar reigons, have an eastward motion, bodily, while circulating around a centrical area. Within the tropics it is otherwise, or westward, till they recurve.

In answer to a question from the Royal Commissioners on Lights, Buoys and Beacons, Sir John Hershel stated that—"the most important meteorological communication which could be telegraphed would be information just fresh received by telegraph, of a cyclone actually in progress at a great distance, and working its way towards the locality. There is no doubt that the progress of a cyclone may be telegraphed, and might secure many a ship from danger by forewarning."

Successive, or rather consecutive gyrations, circuits, or cyclones often affect one another, acting as temporary mutual checks, until a combination and joint action occurs; their union causing even greater effects: as may be seen even in water currents—as well as in the atmosphere.

Between the tropics and the polar regions, or in temperate zones, the main currents are incessantly active, while more or less antagonistic, from the causes above mentioned: besides which, wherever considerable changes of temperature, development of electricity, heavy rain, or these in combination, cause temporary disturbance of atmospheric equilibrium (or a much altered tension of air), these grand agents of nature, the two great currents, speedily move by the least resisting lines to restore equilibrium, or fill the comparative void. One current arrives, probably, or acts sooner than the other—but invariably collision occurs of some kind or degree, usually occasioning a circuit, a cyclonic or ellipsonic gyration; however little noticed when gentle or moderate in force.

As there must be resistance to moving air (or conflicting currents), to cause gyration, and as there are no such causes, on a large scale, near the equator, there are no storms (except local squalls) in very low latitudes.

It is at some distance, from about five to twenty degrees, from the equator that hurricanes are occasionally felt in their violence.

They originate in or near these hot and densely-clouded spaces, sometimes spoken of as the "cloud-ring," where aggregated aqueous vapour is at times condensed into heavy rain (partly with vivid electrical action) and a comparative vacuum is suddenly caused, towards which air rushes from all sides. That which arrives from a higher latitude has a westwardly, that from the lower an eastwardly tendency, due to the earth's rotation, and to the change of latitude, whence a chief cause of the cyclone's invariable rotation in one direction, as above explained.

The hurricane or cyclone is impelled to the west in low latitudes, because the tendency of both currents there is to the westward, along the surface: although one, the tropical, is much less so, and becomes actually easterly near the tropic, after which its equatorial centrifugal force is more and more evident, while the westwardly tendency of the polar current diminishes; and therefore, at that latitude, hurricane cyclones cease to move westward (re-curve), go then eastwardly, and toward the polar quarter.

Great and important changes of weather and wind are preceded, as well as accompanied, by notable alterations in the state of the atmosphere. Such changes being indicated at some places sooner than at others around the British Islands, give frequent premonitions; and, therefore, great differences of pressure

---

[*] Read at the Royal Institution, March 28, 1862. By Rear-Admiral Fitz-Roy, F.R.S. J. P. Gassiot, F.R.S., Vice-President, in the chair.

[†] The Cumming.

[‡] At a recent meeting of the shareholders of the Great Western Docks, at Stonehouse, Plymouth, it was stated officially that "the deficiency (in revenue) is to be attributed chiefly to the absence of vessels requiring the use of the graving docks for the purpose of repairing the damages occasioned by storms and casualties at sea."—(Feb. 24, '62.

[¶] Herschel.

(or tension) shown by barometer of temperature, of dryness or moisture, and direction of wind, should be considered as signs of change, likely to occur soon.

It will be observed, on any continued comparison of weather reports, that during the stronger winds a far greater degree of uniformity and regularity is shown than during the prevalence of moderate or light breezes: and this should be remembered.

When neither of the greater and more extensive atmospheric currents is sweeping across the British Islands—currents of which the causes are remote, and on a large scale—the nature or character of our winds approaches, and is rather like that of land and sea breezes in low latitudes; especially in summer.

Either the cooler sea wind is drawn in, over land heated by the summer sun; or cold air from frosty heights, snow-covered lands, or chilly valleys, moves towards the sea, which is so uniform in temperature for many weeks together, changing so slowly, and but little, in comparison with land, during the year. These light variables may at such times be numerous, simultaneously around the compass on the various coasts of the British Islands.

Frequently it has been asked, "In this country, how much rise or fall of the glasses may foretell remarkable change, or a dangerous storm?"

To which can now be replied—great changes or storms are usually shown by falls of barometer exceeding an inch; and by differences of temperature exceeding about fifteen degrees. A tenth of an inch an hour is a fall indicating a storm or very heavy rain. The more rapidly such changes occur, the more risk there is of atmospheric commotion.

As all barometric instruments often, if not usually, show what may be expected a day or even days in advance, rather than the weather of the present or next few hours, and as wind, or its direction, affects them much more than rain or snow, due allowance should always be made for days as well as for hours to come.

The general effect of storms is felt unequally in our islands, and less inland than on the coasts. Lord Wrottesley has shown by the anemometer at his observatory in Staffordshire, that wind is diminished or checked by its passage over land. The mountain ranges of Wales and Scotland, rising two to four thousand feet above the ocean level, must have great power to alter the direction, and probably the velocity of wind, independently of alterations caused by changes of temperature.

"It not unfrequently happens that a series of cyclones follow closely upon each other for several weeks, the preceding members of the series being often overtaken and interfered with by those succeeding. It is, however, important to remark, that amidst all the complexity necessarily occasioned by such combinations—the greater and more violent storms, and particularly that portion of them which is most dangerous and destructive, exhibit almost invariably the simple cyclonic character. It is thus with the 'Law of Storms' as with the 'Law of Gravitation;' the grand results of both are exceedingly simple, but the minor details become more and more complicated in proportion to their minuteness." *

(*To be concluded in our next.*)

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, April 1st.—J. P. Joule, LL.D., F.R.S., President, in the chair.

Professor Roscoe read the following communication, by Professor Clifton and himself, entitled, "On the Effect of Increased Temperature upon the Nature of the Light Emitted by the Vapour of certain Metals or Metallic Compounds."

In a letter communicated to the *Philosophical Magazine* for January last, we stated that in examining, with Steinheil's form of Kirchhoff and Bunsen's apparatus, the spectra produced by passing the induction spark over beads of the chlorides and carbonates of lithium and strontium, we had observed an apparent coincidence between the blue lithium line, which is seen only when the vapour of this metal is intensely heated, and the common blue strontium line called Sr δ. We further stated that on investigating the subject more narrowly by the application of several prisms and a magnifying power of 40, we came to the conclusion that the lithium blue line was somewhat more refrangible than the strontium δ, but that two other more refrangible lines were observed to be coincident in both spectra. Having constructed a much more perfect instrument than we at that time possessed, we are now able to express a definite opinion on the subject, and beg to lay a short notice of our observations before the Society. Our instrument is in all essential respects similar to the magnificent apparatus employed by Kirchhoff in his recent investigations on the solar spectrum and the spectra of the chemical elements. It consists of a horizontal plane cast iron plate, upon which three of Steinheil's Munich prisms, each having a refracting angle of 60°, are placed; and of two tubes fixed into the plate, one being a telescope, having a magnifying power of 40, moveable with a slow-motion screw about a vertical axis placed in the centre of the plate, and the other being a tube carrying at one end the slit, furnished with micrometer screw, through which the beam of light passed, and at the other end an object-glass for the purpose of rendering the rays parallel. The luminous vapours of the metals under examination were obtained by placing a bead of the chloride or other salt of the metal on a platinum wire, between two platinum electrodes, from which the spark of a powerful induction coil could be passed. In order to obtain a more intense, and therefore a hotter spark than can be got from the coil alone, the coatings of a Leyden jar were placed in connection with electrodes of the secondary current respectively. When this arrangement was carefully adjusted, the two yellow sodium lines were observed to be separated by an apparent interval of two millimetres, as seen at the least distance of distinct vision.

The position of the blue line, or rather blue band of lithium, was then determined with reference to the fixed reflecting scale of Steinheil's instrument, by volatilising the carbonate of lithium in the first place on a platinum wire between platinum electrodes, and secondly on a copper wire between copper electrodes. A bead of pure chloride of strontium was then placed on new platinum and copper wires between two new platinum and copper electrodes, and the position of the blue line Sr δ read off upon the same fixed scale; a difference of one division on the scale was seen to exist between the positions of the two lines, the lithium line being the more refrangible. The salts of the two metals were then placed between the poles at the same time, and both the blue lines were simultaneously seen, separated by a space about equal to that separating the two sodium lines. When experimenting with this complete instrument, we were unable to observe any other blue lines in the pure lithium spectrum than the one above referred to; we have, however noticed the formation of four new violet lines in the intense strontium spectrum, and we now believe that the other two lithium lines mentioned in our letter to the *Philosophical Magazine* are caused by the presence of the most minute trace of strontium floating in the atmosphere, and derived from a previous experiment. We have convinced ourselves by numerous observations that the currents of air caused by the rapid passage of the electric spark between the electrodes are sufficient to carry over to a second set of electrodes placed at the distance of a few inches, a very perceptible quantity of the materials undergoing volatilisation. The greatest precautions must hence be taken when the spectra of two metals have to be compared; and no separate observation of the two spectra can be relied upon, unless one is made a considerable space of time after the other, and unless all the electrodes which have been once used are exchanged for new ones.

Kirchhoff, in his interesting Memoir on the Solar Spectrum and the Spectra of the Chemical Elements,* noticed in the case of the Calcium spectrum, that bright lines which were invisible at the temperature of the coal gas flame, became visible when the temperature of the incandescent vapour reached that of the intense electric spark.

We have confirmed this observation of Kirchhoff's, and have extended it, inasmuch as we, in the first place, have noticed that a similar change occurs in the spectra of Strontium and Barium; and in the second place, that not only new lines appear at the high temperature of the intense spark, but that the broad *bands* characteristic of the metal or metallic compound at the low temperature of the flame or weak spark, totally disappear at the high temperature. The new bright lines which supply the part of the broad bands are generally not coincident with any part of the band, sometimes being less and sometimes more refrangible. Thus the broad band in the flame-spectrum of calcium named Ca β, is replaced in the spectrum of the intense calcium-spark by five fine green lines, all of which are less refrangible than any part of the band Ca β; whilst in place of the red or orange band Ca α, three more refrangible red or orange lines are seen. The total disappearance in the spark of a well defined yellow band seen in the calcium spectrum at the lower temperature, was strikingly evident. We have assured ourselves by repeated observations that, in like manner, the broad bands produced in the flame-spectra of strontium and barium compounds, and especially Sr α, Sr β, Sr γ, Ba α, Ba β Ba γ, Ba δ, Ba ϵ, Ba η, disappear entirely in the spectra of the intense spark, and that new bright non-coincident lines appear. The blue Sr δ line does not alter either in intensity or in position with the alterations of temperature thus effected, but, as has already been stated, four new violet lines appear in the spectrum of strontium at the higher temperature.

If, in the present incomplete condition of this most interesting branch of inquiry we may be allowed to express an opinion as to the possible cause of the phenomenon of the disappearance of the broad bands and the production of the bright lines, we would suggest, that at the lower temperature of the flame or weak spark, the spectrum observed is produced by the glowing vapour of some compound, probably the oxide, of the difficultly reducible metal; whereas, at the enormously high temperature of the intense electric spark these compounds are split up, and thus the true spectrum of the metal is obtained.

In conclusion, we may add, that in none of the spectra of the more easily reducible alkaline metals (potassium, sodium, lithium) can any deviation or disappearance of the maxima of light be noticed on change of temperature.

A paper was read, entitled, "Notes on Calorific Phenomena," by J. C. Dyer, Esq., V.P.

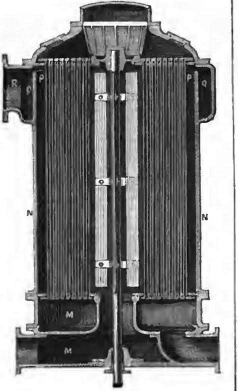
The author states that the *essences* of matter, their number and their forms, are only known to us by their observed properties and mutations; that conflicting theories on physics arise from the various interpretations given to the same phenomena; and if unable to reconcile such differences, further inquiry, with that view, may not be improper, whilst the laws of nature rest on debateable grounds. That practically *matter*, in its aggregate, is found to consist of two sorts or classes—the "ponderable" and the the "imponderable"—gravity and elasticity serving to distinguish their respective inherent properties. That as no tests of weight or measure can apply to the latter, its mutations and action on other bodies are the sole means we have of forming any judgment concerning its agency in the laboratory of nature. That the calorific element, or *heat*, is assumed to be the *one* "sole imponderable element which pervades matter and space throughout the universe," and *it* constitutes the elastic forces reacting upon and *balancing* the gravitating forces in all other bodies. This *elemental state of heat* must be taken as distinct from its other *three* states of sensible, radiating, and specific heat, commonly recognised. That elemental heat is acted upon by mechanical and chemical forces, and the changes which it undergoes from the one to the other conditions of heat, give rise to atmospherical phenomena, known as electrical, magnetic, and optical; as also to the entire range of meteorological changes, as set forth in the paper. That by the mechanical forces of the earth's motion in its orbit and diurnal rotation, acting upon the elemental medium, its equilibrium is disturbed and motions generated which afford rational explanations of the luminous and ordinary electrical and magnetical conditions of the atmosphere, as indicated by their respective meteors. That by the action of chemical forces, great mutations of heat are continually going on; for example, the heat which on a vast scale abounds in vapour, is given out as clouds are formed, and accounts for the positive and negative electricity; and also, when redundant, for lightning from thunder clouds. As much heat is evolved above the clouds, where cold prevails, it must become elemental or neutral there, and justifies the inference that it is identical with the electric fluid, as above said. That electricity and magnetism are but diverse actions of one element has been proved, and their action on matter proves their materiality. The mechanical and chemical action of light proves its materiality also; and that light and heat are identical has been clearly established. The plurality of imponderable elements is, therefore, disproved by the fact that the mutations of the one element fully account for all of the phenomena attributed to several. The gravitating and elastic properties of matter constitute their statical and moving forces, for ever balancing each other. The former of these forces would consolidate the material universe "with lightning speed," but for the reaction of the latter force. There is no reason *why* the force of gravity should be measured by the established laws of falling bodies, except that *experiment* has shown the velocities actually attained by them in vacuo. But this vacuum is the absence of air *only*, not that of the "elastic medium;" and it is this that holds the poise of matter throughout illimitable space.

---

* W. Stephenson, of Dunse, 1853.

* Kirchhoff on the Solar Spectrum, &c. Translated by H. E. Roscoe. MacMillan, Cambridge. 1862.

ROWAN AND HORTON'S SURFACE CONDENSERS.



The above engraving illustrates an improvement in surface condensers for marine purposes, recently patented by Messrs. Rowan and Horton, of Glasgow.

The sea water enters at the bottom by the passage *M*, communicating by a central aperture with the bottom of the tube chamber *N*, and has its exit by a narrow slit or opening *P*, formed round the uppermost part of the chamber *N*. An annular passage *Q* is formed round the shell of the chamber *N*, with which passage the slit *P* communicates, and by which the water finds its way to the exit pipe at *R*. The sea water is thus made to pass off in a uniform current on all sides, whereby the cooling action is rendered more uniform over the tubes.

Several methods are described in the inventor's specification, of securing the tubes in the condenser.

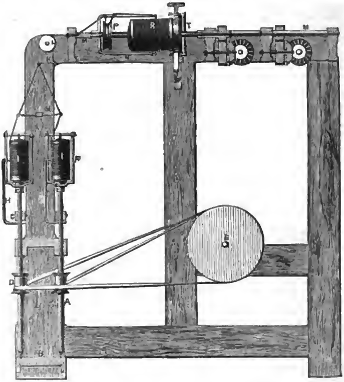
WARD'S TWISTING MACHINE.

The annexed engraving shows a portion of a machine for twisting and laying flax, hemp, and other fibrous materials, the invention of Mr. D. Ward, of Beaminster, Dorset.

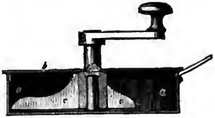
The laid cord or twine may be composed of two, three, or more threads or yarns, and a twist is given to them by driving the spindles and flyers at a suitable speed in the required direction by means of suitable gearing. For the convenience of removing the bobbins from the spindles when required, the flyers are inverted and their upper ends are connected by hinged cross bars, which may be raised so as to admit of the removal of the bobbins. The hinged cross bars also prevent the arms of the flyers from expanding. The threads or yarns having had the requisite amount of twist put into them are conducted over a breast roller to another spindle and flyer revolving in a direction opposite to that of the spindles and flyers from which they received their first twist; by this means the previously-twisted threads or yarns are laid and twisted together into a hard twine or cord, which is drawn on to the bobbin on the spindle by means of a roller or pulley driven by independent gearing, at a speed proportioned to that of the flyer, according to the twist required to be put into the finished cord or twine.

A A represent a pair of spindles with their bottom points resting on a socket in a step rail *B*, and their upper parts passed through a guide rail; the spindles are also driven by wharves or pulleys *D D* from a drum *E*, as usual in spinning machinery; *F F* are flyers fitting the spindles loosely, and resting on a collar formed thereon, as shown. These flyers are open at the top, to which is applied a hinged cross-bar with a hole in the centre to receive the top end of the spindle, the cross-bar being retained by its end being confined in a notch, as shown. The flyers *F F* have adjustable springs applied to them. They have also movable weights *G* resting on the lower ends of the bent rods *H H*, which weights may be changed as required, in order to adapt them to the particular threads or yarns that are being twisted. The use of these springs and weights in combination is to regulate the delivery of the twisted thread or yarn from the bobbins *I I*, so that it may leave them evenly. These bobbins are placed on the spindles (when the cross-bars of the flyer are raised), and united thereto by means of a stud on a collar screwed on to the spindle, being made to enter a hole in the bottom of the bobbin. *K K* are guides for conducting the twisted threads or yarns from the spindles to the breast roller *L*, whence they pass unitedly to the single spindle and flyer *M* and *N*, conveniently placed for receiving the contents of the pair of lower bobbins. This spindle *M* is for laying the previously twisted threads or yarns and twisting them into a hard twine, and is driven by toothed gearing. *P* is a roller or pulley on the hollow shaft for the purpose of drawing the laid cord or laid twine, and giving it the required stretching as it passes to the flyer *N* and bobbin *R*, on which it is wound. *S* is a strap with a weight suspended to it, for the purpose of taking up the laid cord or laid twine. *T* is a traversing guide for the bobbin, working by an ordinary heart motion.

WARD'S TWISTING MACHINE.



MÜLLER'S COFFEE ROASTER.



A very useful apparatus for domestic purposes in the shape of a coffee roaster, has just been introduced to the public by Mr. W. Müllar, of High Holborn. The engraving above illustrates the apparatus.

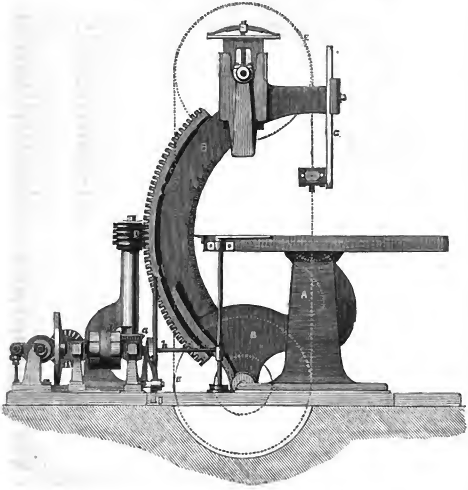
Within a flat circular vessel *a*, adapted to be placed on an ordinary fire, a vertical axis is applied with arms or vanes *c*, to keep the contents in motion whilst over the fire. To this vessel a moveable cover *b*, fitted with a handle to give motion to the axis and afford facility for its removal, besides the handles by which to hold the vessel on the fire during the roasting. An apparatus thus arranged, we are convinced, is especially adapted for domestic use.

GREENWOOD'S SAWING MACHINE.

The object of the machine illustrated above is to facilitate the cutting of straight, curvilinear, and other bevilled forms by means of band saws, the invention of Mr. T. Greenwood, of Leeds. This the inventor proposes to effect by making the inclination of the saw band adjustable to the work while the action of sawing is proceeding.

Two standards *A*, *A*, are secured to the bed plate of the machine, carrying the table; the standards are furnished with bearings for receiving the cranked trunnion supports of a rocking frame *B*, which is made of cast iron of a segmental form, and furnished with rack teeth *C*, on its outer edge, into which gears a worm wheel *D*, for imparting, when desired, an axial motion thereto. Upon the frame *B* is mounted a pair of tension pulleys *E*, which carry the saw band. The uppe

GREENWOOD'S SAWING MACHINE.

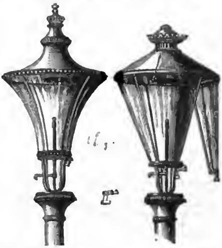


pulley is mounted in adjustable bearings for the purpose of ensuring the maintenance of the saw at a proper tension, and the shaft of the lower pulley is carried by pendent brackets of the frame *B*. *G* is a guide supporting a pendent arm attached to the frame *B* for keeping the saw up to its work. The worm *D* is mounted on a vertical shaft supported in a hollow standard, attached to the bed plate of the machine. Keyed to the lower end of the worm shaft is a bevil pinion *a*, into which a bevil pinion on a short horizontal shaft gears. The opposite end of this shaft is fitted with a bevil wheel, which gears into and is driven by a pinion on a cross shaft, carrying at its opposite end another bevil wheel in gear with a pair of pinions connected to driving pulleys. The worm wheel can be driven in either direction. The arrangement for regulating the rocking of the saw frame is effected by friction gear.

BARNETT'S REFLECTING GAS LAMP.

A very ingenious arrangement of street lamps, for the purpose of reflecting the light on to the pavement, is being introduced. It consists of an enamelled reflector being placed in the upper part of the lamp, as shewn in the above engravings, which represent two shapes of frames. The reflector is fitted with a funnel *B* for the fumes to escape to the crown of the lamp, which is perforated. The pipe by which gas is supplied to the burner is fitted with a cock, having a projecting handle, to enable it to be turned by means of a stick. The door is suspended by a hinge at top, and is furnished at bottom with a catch which is fastened by a self-acting bolt secured to the lamp-frame, as shown in the detached view. It is said by the adoption of the above arrangement fifty per cent. increase of light will be obtained with the same quantity of gas.

BARNETT'S REFLECTING GAS LAMP.



"A young engineer" suggests an improvement in the construction of iron-plated ships, &c. He proposes instead of the backing of teak now used inside the iron plate, to fill up the space with cotton, cotton waste, hemp, or such like material compressed as much as possible by hydraulic pressure, and to lay a coating of it between the teak and iron plates. It is a known fact, he says, that a ball fired against a bale of compressed cotton well secured, will not penetrate it, but will rebound.

RAILWAY ACCIDENTS.

On the 1st of April last, two papers on Railway Accidents were read before the Institution of civil engineers, John Hawkshaw, Esq., President, in the chair.

The first paper read was on "Railway Accidents—their causes and means of prevention, showing the bearing which existing legislation has upon them," by Mr. James Brunlees, M. Inst. C.E.

The Author proposed to treat the subject by dealing with the facts as they were, the causes of accidents being, in nearly all cases, sufficiently apparent; he would not, therefore, attempt by theory, to establish rules for their prevention. From the reports of the officers of the Board of Trade it appeared that, during the seven years from 1854 to 1860, the number of accidents amounted to 540, as the result of 1,274 distinct causes. Of these accidents 11 per cent. were attributed to the permanent way, 7 per cent. to the rolling stock, and 76 per cent. to the management, including insufficient means for securing safety, leaving only 6 per cent. as not ascertained.

The accidents due to the permanent way were then referred to in detail, and it appeared that the general defects were most evident in the system of ballasting, of joint-fishing, of turning the rails, and of fastening the chairs to the sleepers. With regard to the ballast, it was argued that it would be found economical to have at least 6 inches, or 9 inches of rough gravel, or broken stone, as a free draining bed to the sleepers and to the "top-dressing;" and that, during the months of September and October, an extra number of men should be employed to drain the ballast and beat up the road, in order that it might become consolidated before the winter's rains and frosts set in, and thus avoid the evil effects of frost on wet ballast. It was urged that the plan, now in general use, of placing the fish-joint between two sleepers was objectionable, as the ends of the rails were unsupported except by the fish-plates, which together were frequently only equal to two thirds of the section of the rail. It was submitted that all the joints should be fished directly over a sleeper, or that a bracket chair should be used. The practice of turning the rails was condemned, because when a rail was so much worn as to require turning, its strength was generally so reduced as to render it unfit for main line traffic. With regard to the fastenings of the chairs to the sleepers, it was urged that it was desirable that iron spikes only should be employed on the outer side of curves, or else that the chair should be partially sunk into the sleeper, to lessen the strain on the treenail. The superior economy of steeled, or partially steeled, rails, points, and crossings, was also incidentally noticed.

In reference to the accidents which had arisen from defective, or neglected rolling stock, it was found that many of the fractures had occurred during the winter months, owing, possibly in some degree, to the rigid state of the "way" in frosty weather; whilst others were due to the use of bad iron, and some to defects either in the welding of, or in the mode of attaching the tyres of the wheels. Steel, or partially steeled, tyres were now, to a certain extent, in use, and tyres formed of a continuous ring, or unwelded piece of metal, were also successfully employed. Several new methods of fastening the tyres had proved as fruitful of mischief, as the ordinary plan of simply shrinking them on, though others had been found to be efficient; and it was said that on some lines the tyres had not failed to any great extent. The author hoped, that the importance both of the tyres and of the axles of wheels would lead to a useful discussion on this branch of the subject. The usual want of uniformity in the main features of the carriage portion of the rolling stock was then commented upon; and it was considered that this variety not only increased the cost of manufacture and of maintenance, but was often the cause of accidents, and frequently contributed to render them disastrous. The author thought that the carriages should be nearly uniform in size, and that the buffers should, in all cases, be the same height above the rails. The longitudinal beams should be in the same line throughout, be strong in themselves, and the framing securely braced. The present coupling in the centre should be increased in strength, and the whole attachment between the carriages should be such as to render a train in effect, as far as practicable, as one carriage, with a certain amount of flexibility; so that in the event of collision, the carriages should retain their position, instead of rising upon one another; and if an axle, or a wheel broke, the crippled carriage should be partially borne up by the neighbouring carriages until the train could be stopped.

On the question of Management, after some remarks upon the speed of trains, it was shown that by punctuality, both in the time of starting and in the rate of running, safety, so far as human foresight was concerned was ensured. The system of working the traffic of a railway by allowing an interval of time between the trains was deemed unsatisfactory, and far inferior to the system of an interval of space. The accidents arising from the irregularity of excursion trains were then alluded to, and it was remarked that if, during the summer and autumn, the ordinary trains were run at lower rates of fares, the traffic would be increased, as the public would feel greater security in travelling. The difficulty in running coal or mineral trains to a fixed time-table might be met by a more general use of the electric telegraph, and by a better system of signalling arrangements. During the seven years, from 1854 to 1860 inclusive, 88 accidents happened from inefficient signals, of which 14 occurred in 1860. In some cases, especially at sidings, there were no signals; in others they were defective in form, or were inproperly placed. It was desirable that junction signals and points should be worked simultaneously by one man, and at junctions, separate main and distance signals should be provided for each line. If the system of working the traffic by the electric telegraph was generally adopted, and the line was divided into sections, so that a train should be prevented from entering any section until the preceding one had passed to the section in advance, collisions would be impossible, except those liable to arise from disregard of the signals, and a proper interval would be secured between the trains, in spite of unpunctuality. As the want of a means of communication between the engine-driver and the guard, or conductor, had frequently been experienced, and as plans were in daily use on several lines, there was no reason why it should not be adopted on all. To render it fully effective, the guard, or conductor ought to start the train from each station by means of that machinery, so as to prove that it was in working order. Owing to the general high speeds and heavy trains, it was of the utmost importance that ample break power, capable of being applied in the least time, should be provided with each train. It was a question how far a regularly distributed retarding force, acting at the same moment on all the wheels, might not be preferable to a concentrated force applied at particular points. By the system of "continuous breaks," the employment of several men with each train was unnecessary. It had also another advantage, that a train was more under control, and could be stopped in a shorter distance. The negligence of servants, arising from their ignorance or inefficiency, was next adverted to, and it was thought to be due to the pay being too low to command the services of men of intelligence, steadiness, and self-reliance. Frequently they were insufficient in number, leading to overwork, and instances were on record in which engine-drivers had been employed for seventeen hours daily, and in some cases for twenty-six and thirty hours continuously.

The Author proposed leaving the bearing of existing legislation upon railways to be dealt with by Captain Douglas Galton. He would, however, observe, that Government interference was not likely to render railways safer, or more available to the traveller; and that it would be better to rely on the consideration and calm reflection of those immediately interested in these enterprises, especially as from the heavy expenses attendant on accidents, directors and shareholders would naturally desire to render this mode of travelling as safe as possible.

The Second Paper read was on "Railway Accidents," by Captain Douglas Galton, R.E., F.R.S., Assoc. Inst C.E.

It was stated that the length of railway communication opened in the British Isles at the end of 1860, was 10,433 miles, upon which 163,435,678 passengers were conveyed in that year. From official returns it appeared, that during the seven years ending the 31st December, 1860, there were 116 passengers killed, and 2832 injured, from causes beyond their own control. From the sums paid by railway companies for compensation, it was calculated that an insurance of one twenty-fourth part of a farthing per passenger per mile would, on the average of all lines, cover the cost of railway accidents. It had been found impossible to obtain reliable information, as to the number of coach accidents in this country. But the returns of the 'Messageries Impériales' showed, that in a series of years, the number of passengers killed and injured, from causes beyond their own control, was 1 in 28,000. From the latest comparative returns, the number of passengers killed and injured was on British railways 1 in 334,000, on Belgian railways 1 in 1,600,000, on Prussian railways 1 in 3,000,000, and on French railways 1 in 4,000,000. The greater comparative safety of foreign railways was traced to differences in the conditions of the traffic and of the management, as well as in the habits of the people.

In endeavouring to elucidate the question, whether any of the accidents which had occurred could have been prevented by reasonable precautions, the first point which arose was, the extent to which the amount of traffic on the several lines influenced the number of accidents. The general averages thus obtained showed, that lines of small traffic were comparatively safe. But as traffic alone did not determine the number of accidents, it was necessary to analyse the causes in detail; taking first, those which could not be guarded against, and secondly those which were within the control of the managing, or working staff. During the seven years before referred to, 534 accidents to trains had been reported upon by the Inspecting Officers of the Board of Trade, in which 2912 passengers were killed, or injured. In many of these cases there had been more than one contributing cause but the majority might be thus tabulated:—

	Number of Accidents reported upon.	Number of Sufferers.	Cases in which the Accidents could not be guarded against.	Cases to which the Accidents were due to Causes within the control of the Management.		
				Attributable to [illegible] Works [illegible]	Attributable to the system of Working.	Negligence of Inferior Servants.
Accidents from Engines and Carriages leaving the Rails, or Fractures of Machinery	135	[illegible]	[illegible]	[illegible]	15	12
Collisions of every description	319	2,4[illegible]	16	[illegible]	120	183

These figures showed that a large portion of the so-called accidents were due to preventible causes. Those arising from the fracture of axles and tyres, and from engines and carriages leaving the rails, were less than one-half of the number which could not have been guarded against. But out of the 319 collisions, only 16 were attributable to purely accidental causes, whilst 183 were assigned to the negligence of inferior servants, and 120 to the manner in which the traffic was conducted and which ought not therefore to have occurred.

With regard to the first class of cases, accidents which could not have been guarded against, the Author remarked, that the best form of tyre for a railway wheel had not yet been definitely settled. The wheels and axles could scarcely be said to be mechanically satisfactory; the form of break in use was also imperfect. Although simple negligence could not be entirely prevented, yet in several cases the negligence had been attributable to the defective arrangement of the company, in permitting pointsmen and engine-drivers to be habitually over-worked.

Those accidents which arose from trains passing on to a wrong line through facing-points, might not have occurred, if an indicator had been attached to the points, to show in which direction they were set. The comparatively small number of accidents from negligence alone afforded strong evidence of the efficiency of the direct responsibility of the inferior servants. A few instances were then cursorily alluded to, in illustration of those accidents which were wholly, or partially attributed to defects in the condition of the railway, or the vehicles, or to the absence of the requisite auxiliaries to safety, such as signals, breaks, &c. It was observed, that it was not for want of good rules that accidents occurred, but for want of a continued enforcement of those rules, and a close examination into the details of the manner in which the traffic was worked.

The discussions which had taken place on this subject in Parliament, both in 1853, and again in 1857, were then considered, and the conclusion was arrived at, that freedom from railway accidents was not to be obtained by Government interference, but by an effective and responsible internal management, which would enforce the greatest punctuality and care in working the traffic, and maintain the strictest discipline amongst the servants employed.

The existing law affecting railway companies as carriers, was then alluded to; and attention was next called to the principle of compensation for injuries sustained, Lord Campbell's Act being specially cited, as the Parliamentary recognition of that principle. It was said that this Act removed a technical difficulty in the way of recovering compensation, rather than gave a new right to compensation. The money payment, thus provided, operated as a punishment, and tended to prevent the commission of careless acts. Compensation might, therefore, be looked upon, partly as a penalty upon the company for its corporate carelessness, and partly as a remedy to the sufferer for the injury received. If viewed as a remedy, it should be such as to tend to prevent a recurrence of the act for which punishment was awarded. It should, therefore, depend on the degree of blame which attached to the management for the accident, and it should be equally certain and just in its operation. In its aspect as a remedy, it should be easily recoverable by the sufferer. As at present levied, it did not properly fulfil either of these conditions, for reasons which were stated. Assuming that such a maximum amount was fixed upon as would fairly compensate the generality of passengers, according to the class in which they were travelling; and assuming that it were made payable in the case of every accident which occurred, beyond the control of the passengers, without there being any obligation to prove negligence, the author was inclined to think, that the fine would be rendered more certain in its operation, but that as a preventive the effect of the alteration would not be appreciable. The true remedy against railway accidents lay, in the author's opinion, with the railway companies themselves. Improved management would be greatly assisted, by placing at the head of each railway a director of adequate capacity, responsible to the board for the management of the concern, who should be required to devote the whole of his time to its interests, and be paid in proportion;—by giving the chief officers of the railway control of, and making them responsible for, the several departments, so that they might be held answerable for the results; and by providing a gradation of responsibility throughout all the employés. Improvements in the machinery, and system of working, might be promoted by the formation of an association amongst railway companies, embracing the objects of the association between the German railway companies, and of the association between manufacturers, near Manchester, for the prevention of boiler explosions. It was doubtful, however, whether such an association could become of any practical utility in this country, unless it assumed the form of an association for the purpose of mutual insurance against accidents, managed by a board of railway officials, chosen from the associated companies.

TO CORRESPONDENTS.

Received.—N. L., J. W. W., J. H., R. R., R. W. W., R. J. B., A. B. C., J. S., W. R., J. S., W. T., S. and M., A. G., X. Y. Z., Capt. B. P., J. N., Capt. N., J. A. D., E. J. R., G. S., R. A. G., W. H. C., G. S.

Erratum.—In Capt. Selwyn's letter in the last number of the M. M., thirty-fifth line from the top, second column, read "float in air" for "heat in air."

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

LOCAL HEAT IN THE RED SEA CABLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

10 Cannon-street, E.C., London, April 16th, 1862.

Sir,—In your Journal of last week, under the head of "Telegraphic Intelligence," and in an article relating to the progress of the work of repairing the Red Sea cable, it is stated that Mr. Clark has found several instances of the action of local heat upon the cable, presumed to have arisen from volcanic action on the bottom, or from the presence of boiling springs.

Having just returned from Egypt, where I have been staying some time, and where I paid great attention to the important points involved in the safe establishment of the telegraph to India, I think it right to say that in my judgment Mr Clark is entirely mistaken as to the existence of local heat at the bottom of the Red Sea, and as to the supposed fact of any portion of the cable having received injury from that cause. The most diligent inquiries and observations have led me to the belief that no vestige of volcanic action exists along the whole course of the bottom upon which the telegraph cable is laid, but that, on the contrary, if carefully surveyed in the first instance, and if, as in the case of laying the Malta and Alexandria Government cable, a pilot ship be kept constantly ahead of the vessel from which the cable is being paid out, in order to sound and point out the course, a strong and durable cable can be submerged in those waters with every probability of a most successful and permanent issue.

I am aware that by some few persons the question of establishing a land line of aerial telegraph along portions of the shore of the Red Sea has been mooted and proposed to be placed under the protection of the native sheiks. If your readers could only see and hear as much as I have done respecting these gentry during the last six months, I can assure you we should hear no more of a project so utterly futile. The Bedouins along the Red Sea coast are divided into an indefinite number of separate tribes, each constantly at war with the other, and having no one sentiment in common except that of universal plunder, and I do not hesitate to say that however subsidized, as has been proposed, they are by nature so unprincipled, that the telegraph wires and poles so useful and convenient for many of their everyday requirements would never be safe from their depredations from one twenty-four hours to another.

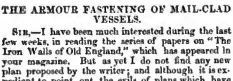
I remain, Sir,
Your obedient servant,
R. A. Glass.

◆

THE ARMOUR FASTENING OF MAIL-CLAD VESSELS.

Sir,—I have been much interested during the last few weeks, in reading the series of papers on "The Iron Walls of Old England," which has appeared in your magazine. But as yet I do not find any new plan proposed by the writer; and although it is expedient to point out the evils of plans which have been originated or applied, yet the increasing importance of a more efficient maritime defence to England demands that we should not be content with negatively declaiming against that which is inferior, but that we should immediately endeavour to attain a superior position to the one we now hold.

Deeming it then the duty of every Englishman to further the interests of his country, I submit to you my plan of fastening the armour of mail-clad vessels, of which the accompanying drawing is a section. The armour is composed of two sets of rolled bars, the inner set of which is fastened to the side of the vessel by tap bolts, as shown. The outer set is held fast between the projecting ribs on the inner bars. By using smaller pieces of iron instead of the massive plate of the ships already plated, many advantages will be gained, which ought not hurriedly to be set aside. The buckling, the great strain on the holding bolts, owing partly, I believe, to the great weight of the plates, and the enormous cost, will be done away with. A greater thickness will be attainable, as in the plan now before you, the dimensions being total thickness of armour 8 inches, thickness of flanges of inner set 2 inches, total height of ribs 6 inches. The bars will be more easily fitted to the curves of the vessel and more likely to be free from blemishes.



The great causes of the failure of the Thorneycroft plan, seem to be the number of angles, which are always found to be weak points, and the wrong position in which the bars were placed, viz., with their edges or smallest surface resting against the backing, which instead of transmitting the blow over a large surface, contracted it and consequently increased the force. Both these faults will, I think, be removed by the plan under consideration, which will, at least with such alterations as more experienced men may point out, prove an efficient armour for our navy.

Hoping that you will be kind enough to insert this in your paper, and give me your opinion upon it.

I remain, Yours truly,
W. H. Taylor.

Hartlepool, April 7, 1862.

◆

CARBON IN IRON.

Sir,—In your last week's journal, you give a mode of analysis which you designate as "an ingenious and simple method of determining the quantity of carbon in cast iron and steel—without the previous and difficult pulverization of the metal"—"The method," you say, "consists in making the iron to be analyzed the positive electrode in dilute chlorohydric acid when the iron disolves, leaving the carbon and without evolution of gas."

Permit me to point out to you that this method is not new.

It is due to Mr. Christopher Binks, who, in his paper read at the Society of Arts, in 1837, states this very method as his own, and as the best way for determining both the proportion and the quality of the carbonaceous matter contained in steel.

The following extract from Mr. Binks's paper shows this:—

Under the head of "Some evidences of the analysis as to the real composition of steel," he says, (other evidances being adduced), "The best malleable iron on the one hand, and by way of comparison with this, the same kind of iron fully converted by the usual process, were taken on trial; the steel was dissolved in vary dilute and pure hydrochloric acid, and after many trials it was found best to place the bar of steel or iron in single voltaic arrangement with platinum, and to effect the solution in the cold with the usual precaution of expelling air from the water employed. In this way, slowly, the steel was dissolved, and the carbonaceous flocculent matter that was left collected, carefully dried, and analysed. The iron was treated in the same manner, and the comparatively very small proportion of carbonaceous residue given by it also examined. And these were compared with the residue obtained also from cast-iron. If the acid be strong, and heat be used, and the voltaic arrangement be not used, the results are very different. Gaseous nitrogen, in very minute quantity, is given off along with the hydrogen, some muriate of ammonia is formed in the solution, and but little nitrogen left in the residue."

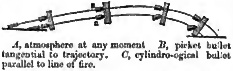
Herr Weyl, who announces this as his method of analysis, is not the only one, (M.M. Fremy, Caron, and others for instance), who have been anticipated in this paper of Mr. Binks.

I remain, &c. John Stebbing.
Inverness Road, Bayswater.

◆

"IN HOW MUCH CAN A RIFLE PROJECTILE BE TANGENTIAL TO ITS PATH?"

Sir,—In the communication of Captain Selwyn in your impression of the 11th inst., he mentions that he had at 1,000 and 1,500 yards range found the position in a butt and through wood of a picket-shaped or Jacob bullet to be confirmatory of the view that in such instance tangentiality had been secured, and not parallelism maintained. This happens to be of much interest to me, for by an accidental circumstance noticed some years ago while pursuing a different object, I have been long under the impression that the picket or Jacob bullet was more likely than any other to be tangential—I mean than any other bullet having the centre of gravity further forward.* The latter has indeed been assumed commonly to be the only way by which tangentiality could be brought about, but the gyroscope shows that it is not by having the centre of gravity in advance of the geometrical centre that the desired position can be affected. I found that if a spheriod be composed half of heavy metal, and half of light wood, (a sphere would do as well, and doubtless less excentricity also) that in whatever position the excentric centre of gravity is (such as above, or below, or to one side) when rotation is impressed in spinning the body on a table, the position then assumed is that of centre of gravity above the geometrical centre, and what in a state of rest would be unstable equilibrium. Now the relation of the axis of rotation of this excentric body, and of the centre of gravity in such axis to the plane of the table, may be applied to the axis of rotation of the picket bullet referred to, the position in it of the centre of gravity, and one of the infinite planes of the atmospheric strata, assuming for convenience sake that the projectile has to pass through a number of atmospheric strata lying in planes perpendicular and normal to the trajectory, thus:—



A, atmosphere at any moment *B*, picket bullet tangential to trajectory. *C*, cylindro-ogical bullet parallel to line of fire.

A high amount of helical or rifle rotation being impressed on the picket necessarily, for we know that rotation is demanded, inversely as the centre of gravity of a projectile is towards its front, while if helical rotation is given to a projectile having the centre of gravity far forwards in its length, or the congreve rocket (with a stick), then there is an attempt at rotation about an axis in the direction of a normal to the trajectory, and which thus by the resistance of the air destroys the stick, as was seen in Hales' rocket, and obliged him to dispense with the stick. It is not commonly enough recognized that to be tangential to its path, a bullet must describe a partial rotation on a horizontal axis passing through its centre of gravity perpendicularly to the plane of the trajectory. This partial rotation may be termed the lunar or tangential rotation. A helical rotation on its longitudinal axis having been previously imparted, so that here we require two rotations to go on at once, but without their natural resultant, viz., the third or unwished for rotation, which in the rocket destroys the stick. There is, however, this great difference between a long cylindro-ogical rifle bullet weighted towards its head, and the Jacob projectile, in the former much more than in the latter is violated the well-known law; for it is by the principle of the arrow or the vane would be given the lunar rotation to the first, by a force—the air—acting on the longer lever posterior to the centre of gravity, in short, a force passing through the axis of prior rotation or long axis, but not through the centre of gravity. Whereas in the picket or Jacob bullet that force does pass more nearly through the centre of gravity, for the centre of gravity lies much nearer to the base, and the assumed lunar rotation is not so much caused by that force as it is by the centrifugal force acting in such a bullet, as the centrifugal force does in a very excentric sphere spun on a table: viz., in tending to keep the centre of gravity at the greatest possible distance from the extremity of the axis or point in the projectile (apex) on which the projectile is rotating and which would meet first the resistance opposed to it, in one case a table, in the other, an atmospheric stratum lying in a plane normal to the trajectory. But if at all, it can be only up to a very limited elevation that any kind of rifle bullet can be made to turn partially, so as to be tangential, otherwise we should long since have heard of rifled mortars.

I remain, Sir, your obedient Servant.
B. W. Woollcombe,
14 St. Jean d'Acre Terrace, Stoke, Devonport,
April 14th, 1862.

◆

INSTITUTION OF NAVAL ARCHITECTS.

13th April, 1862, 17 Cowper-street.

Sir,—We all expected great things from the deliberations at the late meeting of the Society of Naval Architects. How sadly we have been disappointed. I believe the evil consists in many of the active members having schemes of their own, and are anxious to do the best they can for themselves, and not for the society. Looking seriously at the plans of one or two of those gentlemen, I should say they feel perfectly satisfied that the first shot will bring their target down like a pack of cards.

But there are hopes in this society, under the management of Mr. Reed; and great good would arise if a committee met every week to take into their serious consideration all schemes and inventions for the improvement of our navy. Anything that bore the impress of sound judgment should be sent to the Admiralty, and others returned.

In this way, by sifting the good from the indifferent, the Admiralty might be able to move on. At present they are in a complete fix. Models left with them a month ago are not even looked at. Things are done differently at Paris. A friend of mine went there the other day, and in less than twenty-four hours he was before the committee with models, plans, &c., and in a short time everything was settled. Now this is just what this society could help the Admiralty to do—recommend what is good, put aside what is useless.

I am, dear Sir, yours,
A Thirty Years Subscriber.

◆

CROSS FISHING FOR MONITORS, WITH A SUBMERGED BEELZEBUB FOR A BAIT.

Sir,—It is very natural for men to invent invulnerable iron-cased men-of-war to run down other men-of-war. It is also very natural for men to devise a means for disposing of invulnerables. I propose to do it after this manner: I would have two *swift* steamers to run across the invulnerable at a convenient distance from him, a submerged beelzebub charged with a ton of gunpowder, and connected to each steamer with a rope at equal distances, the steamers could by this means draw the beelzebub under the bilge of the invulnerable, and when there explode by means of my water-proof frictional ignitor. I hope when the weather becomes more genial, practically to shew in a small way, here at Kingstown, the manner by which the process can be carried out. I am, &c., J. Norton.

◆

UNITING ENGLISH AND FRENCH RAILWAY.

Sir,—In reply to your note referring to my calculations of the material, &c., required for *Neptune's* project for uniting the English and French railways, I beg to say that the average depth of the Channel is about 120 feet; then say 30 feet for the highest tides, an' [illegible] 'op o mbankment, we have 190 *feet*. The Channel is 20 miles in width; consequently, Neptune's embankment would be 105,600 feet in length, and, as he proposes one mile in width between the walls, we would thus have 105,600 × 5,280 × 190 = 107,457,920,000 feet, or nearly 4,000,000,000 cubic yards; then allow 25 per cent. for protection walls, sloping sides, and his four harbours of refuge, and we have the 5,000,000,000 yards as stated in my last, the other calculations being correct, as a matter of course.

---

* The late General Jacob, though apparently with another object, threw the centre of gravity of his bullet still further back, by having an iron apex, indeed the front half was iron.

Your obedient servant, A. B. C.

London, 12th April, 1862.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

April 10*th*.—Mr. James B. Walton, Vice-President, in the chair.

On Single and Continuous Straight Girders.

By Francis Campiu, President.

After a few preliminary remarks upon the impulse of the progress of bridge-building by the introduction of wrought iron as a material for that purpose, the author proposed to explain a simple and practical method of proportioning the flanges of straight girders. The amount of strain upon any part of a straight girder might be calculated to the greatest nicety by formulæ deduced from mathematical investigations, which, however, are generally too complicated to be practically available.

The curve of strain upon a girder simply supported at each extremity, is a parabolic segment, which, however, may be closely approximated by a circular segment, hence the least area of any section of the flanges may be measured on the ordinates of a curve drawn as follows:—

Find the area of the centre of the girder, from which point lay off a scale at right angles to the girder, an ordinate representing such area, then describe a circle passing through the extremities of the ordinate and line of girder. It is desirable that the vertical scale of areas be as small as possible in proportion to the horizontal scale. The area of either flange at the centre, including loss by rivets, may be found from the expression,

$$0{\cdot}0313 \cdot \frac{w\, l^2}{d}.$$

Where w = load, in tons, per foot run, l = space in feet, d = depth in feet, the result being the area in square inches.

One space of a continuous girder may be regarded as virtually divided into two or more parts, a central part acting as a girder, supported at each end, and limited in length by the points of contraflexure, which part may be treated exactly as any ordinary single girder, as described above, and one or two end parts, of which each acts as a girder, fixed at one end and free at the other, bearing an uniform load w per foot run distributed over its length, and a concentrated load at its extremity, equal to half the total load on the central part of the girder. The area at the point of fixture being found for either flange from the expression,

$$\frac{W x}{8 d}.$$

Where W = total load on half beam, and on central part d = depth of girder, x = distance of point of contraflexure from point of support = length of half beam. All that remains to be determined is the value of x, which corresponds to a minimum area of the curve of strain.

The author then explained the process of finding x, which gives for a beam fixed at both ends,

$$0{\cdot}215\, l.$$

And for a beam fixed at one end and supported at the other,

$$0{\cdot}25\, l.$$

In the case of a continuous girder, the value of the x's are assumed, first as equivalent to one of the above quantities, and then reduced to give an equality of area over the points of support, whichever space such area is calculated from.

The author then proceeded to find the actual saving from the use of continuous girders, and from a calculation of numerous existent cases found that it sometimes amounted to 25 per cent. of the weight, averaging about 18 per cent. These results were obtained from an empirical formula; for the weight of metal in a bridge, supposing single spans to be used, it is,

$$\frac{b\, l^{2{\cdot}25}}{10{,}000}.$$

Giving the weight in tons, b = the breadth, and l = the span, both in feet, the quantity, 2·25, being found from the expression,

$$n = \frac{\log. w - \log. w' + \log. b' - \log. b}{\log. l - \log. l'}.$$

In which w, b, l, w', b', l', are the weights, breadths, and spaces for two cases. $n = 2{\cdot}25$ was the mean result of a number of solutions of the above equations.

MEETINGS FOR THE WEEK.

Mon.—*London Inst.*, "On Birds," by R. Owen, Esq., at 7 p.m.

Medical Soc., at 8.30 p.m.

Wed.—*Society of Arts*, "On the Effect of Prizes in Improving Manufactures," by S. Sidney, Esq., at 8 p.m.

London Inst., "On the Seven Metals of the Ancients," by F. Field, Esq., at 7 p.m.

Thur.—*Soc. for the Encouragement of the Fine Arts, Conduit-street*, "Painting and Painters in England, from 1760 to the present time," by Mr. H. Ottley, at 8 p.m.

Civil and Mechanical Engineers Soc., I. Resumed Discussion on "Single or Continuous Straight Girders," by Francis Campin, C.E. (President). II. "On Coal," by Mr. R. C. Paterson, at 7.30 p.m.

Fri.—*London Inst.*, "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.

Gossip.

◆

The new paper currency for British India, as devised by Mr. Wilson, and perfected by his successor, Mr. Laing, was brought into legal use on the 1st day of last month. That day marks, therefore, an important epoch in the history of our rule in Hindostan. We trust, and believe, it will mark the commencement of a prosperous era for Her Majesty's subjects—black and white—in that sunny land. The notes are neat in appearance, one before us, for 20 rupees, bears the following inscription in bold letters on white ground:—

"Government of India.

"*Promise to pay the Bearer on demand the sum of*

Twenty Rupees.

"1861, *July* 12. *Calcutta*, 12 *July*, 1861."

On the right hand side is an effigy of the Queen's bust enclosed in a wreath. Over the words "promise" and "demand" is the English No. of the note repeated, and below this the value in Bengalee, Persian, Nagree, and Hindu. In the tissue of the note, as a watermark, its value is thrice entered in words and figures. Below are the signatures of Jas. Wilson and "Canning." Forgery, therefore, will be difficult, if not impossible. If there be a fault in the artistic portion of the note, it consists in the juvenile aspect of the Queen, and Her Majesty's fantastic habiliments, which give her the appearance of a Sultana rather than that of the monarch of the British Empire. Possibly this latter arrangement is intended as a delicate piece of flattery to the "natives;" but a truthful delineation would have shown the possession of better taste on the part of the Home Government, who are responsible. A practical fault is said to exist in the omission to print the numbers of the notes in Bengalee.

The *Times* says—A return which has been presented to Parliament, on the motion of Mr. Laird, states that the Warrior can enter none of Her Majesty's graving docks except two—Pembroke at average spring tides when drawing not more than 22ft. of water, and the Double Docks, Nos. 7 and 10, at Portsmouth six days each spring tide, fully loaded and ready for sea. But the New Long Dock at Devonport is being so constructed that the Warrior can be docked there on any day; the Queen's Dock at Keyham is under alterations, the effect of which will be that the ship can be docked any day by raising the water in the basin; the North Inlet Dock, which is being constructed at Portsmouth, will be such that the ship will be able to enter any day when in the basin or when it can enter the basin; and No. 2 Dock at Chatham is being so altered that the ship will be able to enter there four days each spring when "light."

Mr. Robert Richardson, of 20 Great George-street, Westminster, has sent us a letter asking our co-operation in a necessary and commendable work. He says, "The determined hostility evinced in certain quarters against inventors having any property in their own inventions, and the fact that notice of a motion on the subject of the Patent Laws has been given in the House of Commons, by a well-known opponent of the rights of inventors, place it beyond doubt that most strenuous efforts will be made during the present session of Parliament to effect serious alterations in the laws relating to patents. What the contemplated alterations may amount to, remains to be ascertained; but, judging from the animosity shewn by many interested in the abrogation of patents, it is evident that, even supposing a total repeal of the present system will not be attempted, yet determined efforts will undoubtedly be made to inflict very serious injustice, and to vexatiously impede by every available obstacle, the granting of patents for the future. With these views, it is proposed that an Association should at once be organized, the objects of which should be to aid in efficiently checking any unfair encroachments which by legislative enactments may be attempted on patent property, and to promote, as far as can legitimately be done, the interests of inventors. To give publicity to the movement, and to assist in the formation of the Association, a public meeting will shortly be held. It is proposed to limit the subscriptions of annual members of the Association to one guinea per annum, and that of life members to ten guineas."

If the International Exhibition of 1862 succeeds, it will do so in spite of blunders, incapacity, and folly. A document, explaining the nature of the state ceremonial which will take place on the occasion of opening the Exhibition has just been sent to the guarantors of the Exhibition and others. This document says, "Her Majesty's Commissioners request that gentlemen occupying officially reserved seats will appear in Uniform, Official, or Court dress." The International Exhibition of this year has sprung from the scientific suggestions, the industrial energies, and the commercial enterprise of the *people* of this country in particular. Our leading manufacturers came forth in the most generous manner, and guaranteed the sum necessary for the great work; and now these men are invited to appear dressed as flunkies at the opening ceremony. It is a remarkable thing that almost everything worthy of admiration in England springs from the people of England, but no sooner does it achieve a great success than attempts are made to smother it in the embraces of snobbism.

E. Mulder has published a large work on the estimation of carbon in iron, in which, after reviewing all other processes for estimating carbon, and showing them to be more or less defective, he gives the following as the best for the purpose. A long combustion tube of the hardest possible glass is drawn out at the end and plugged with asbestos. The tube is then filled two-thirds full of sand which has been ignited in oxygen. The iron filings, previously washed with sulphuric acid and then mixed with pumice which has been ignited in oxygen, are now placed in the tube, then a layer of oxide of copper, and lastly a plug of asbestos. A chloride of calcium tube is then connected, also a tube with peroxide of lead to retain sulphurous acid, then a drying tube with sulphuric acid and pumice, and lastly the potash apparatus. A stream of oxygen is then slowly passed, and the tube is heated first gently and then as strongly as possible. The success of the experiment seems to depend a good deal on having enough sand. When his tube was only half full, the author only obtained 4·42 per cent. of carbon. When two-thirds full, he obtained 5·02 per cent.—*Chem. Centralblatt*, 1862, s. 46.

At the meeting of the American Photographical Society last Feburary, Dr. Henry D. Noyes exhibited a negative showing the optic nerve and interior of a rabbit's eye. The impression was obtained by a newly invented instrument devised by himself and Mr. Grunow, a practical optician. Such a photograph has never been obtained before in this country, although it is said to have been done in France. The interior of the eye, namely, the retina and optic nerve, has been disclosed to observation in the living person, by an instrument invented in Germany, called the opthalmoscope. This has been in use for ten years, but it is only now that the interior of the eye has been photographed. Dr. Noyes explained the working and principles of the new opthalmoscope, by the aid of diagrams and the presentation of the instrument itself. Through it diseases of the eye can be studied with greater facility, and scientific records of them kept. The instrument displayed, in its elegant and finished workmanship, the highest mechanical skill. The discourse of the doctor was listened to with close attention, and the audience expressed their approbation by applause.

A New Discovery.—M. Luis Lucas, a gentleman well-known for his scientific attainments, on Thursday last received a select circle of visitors at his house, to exhibit and explain the principle of an apparatus of his own invention, by which a physiological fact of great importance is rendered apparent, viz., the direct action of the living frame on the magnetic needle. The apparatus itself is of extraordinary simplicity. A single element of Bunsen's battery has its poles in communication with an electro-magnetic bobbin, surmounted by a graduated disc, bearing a magnetic needle which oscillates freely round its centre, as in the common compass. This part of the apparatus is protected by a glass shade; the plate may be raised and lowered at pleasure by a wheel and rack. The conducting wires, after communicating with the bobbin, branch out towards the operator, and are connected together by a loose metal chain. The apparatus being in this state the needle remains perfectly quiescent, until the operator takes hold of the chain, either with one hand or both, when the needle at once begins to move, describing arcs of from ten to ninety degrees. No principle hitherto admitted into physical science can account for this strange phenomenon, and we are compelled to admit a physiological action capable of producing such motion. The experiment was varied in many ways in our presence, and we were ourselves allowed to test our individual power on the needle. That the cause of the motion was of a physiological nature was further proved by the circumstance that the oscillations of the needle varied in intensity according to the persons experimenting, and even according as the same person might be differently affected either by tranquillity or a warm discussion, such different states naturally modifying the susceptibility of the nervous system. Stranger still, some persons present produced the oscillations by merely touching the chain with a glass rod about two metres in length, glass being, as our readers know, a non-conductor. Whatever explanation may hereafter be given of M. Lucas's discovery, one fact seems even now indisputable, namely, that the human body may directly influence the needle; what consequences may be evolved therefrom time alone can show.—*Galignani.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2422, 2450, 2455.
Boilers and their Furnaces, &c., 2392.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2393, 2432, 2454.
Ships and Boats, including their fittings, 2437, 2442, 2448.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2407, 2418, 2452.
Food and Beverages, including apparatus for preparing food for men and animals, 2394, 2400, 2403, 2410, 2435.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2390, 2402, 2440.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2408, 2416, 2424, 2449.
Lighting, Heating, and Ventilating, 2391, 2396, 2397, 2409, 2412, 2415, 2419, 2426, 2436.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2398, 2401, 2406, 2411, 2413, 2423, 2427, 2428, 2430, 2443, 2447.
Metals, including apparatus for their manufacture, *None.*
Chemistry and Photography, 2434, 2441.
Electrical Apparatus, 2395, 2425, 2429.
Warfare, 2414, 2433, 2439, 2445, 2446, 2453.
Letter-Press Printing, &c., *None.*
Miscellaneous, 2388, 2389, 2399, 2404, 2405, 2417, 2420, 2421, 2431, 2438, 2444, 2451, 2456.

2388. C. G. Lenk. *An improved tank pen.* Dated Sept. 25, 1861.

This consists in making pens for writing or designing, of metal, porcelain, glass, india-rubber, and gutta-percha. The pen-holder is a cylinder, and is made of brass, or any of the above-named materials. In the top of this cylinder is a screw, in connection with a wire which goes down the cylinder in the pen to open or close the same at liberty by a pressure of the screw, through which operation the stroke can be made fine or thick. The pen is at the bottom of the cylinder, and made of steel like the common writing pens. The chief thing consists of a little hole in the pen through which, by a certain pressure of the air, the pen is allowed to discharge only the quantity of ink required. *Patent abandoned.*

2389. J. Musgrave. *Certain improvements in the application of steam power.* Dated Sept. 25, 1861.

This consists in the application of two or more steam cylinders of small diameters, placed in a vertical, horizontal, or diagonal position, and connected direct to a main driving shaft, or to a second motion shaft, thereby entirely dispensing with the large fast motion wheels, fly wheels, large engine house, and heavy foundations now required. *Patent abandoned.*

2390. S. Bright and R. Mills. *Improvements in apparatus or means employed in the printing of yarns or carpets and other fabrics.* Dated Sept. 25, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2391. H. Purnell. *Improvements in constructing and arranging warming apparatus.* Dated Sept. 25, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2392 R. A. Brooman. *Improvements in apparatus for letting off water from, and for admitting oil or other lubricating matter into steam cylinders.* Dated Sept. 25, 1861.

The apparatus for allowing water to escape from steam cylinders is composed of a tube screwed on to the cylinder, opening through another tube into a spherical or other suitably shaped chamber, in the bottom of which is a valve in the form of a plunger, kept in position to allow of the outlet of water by a spring; the top of the valve is in the form of a cup, in which the tube communicating with the cylinder dips. The valve is open until the admission of steam on one side or other of the piston, as the case may be, issuing through the tube and pressing on the cup closes the valve, and keeps it closed until the commencement of the return stroke, when any water which may have become condensed escapes, and so on. The apparatus for admitting lubricating matter consists of a cup closed at bottom by a screw valve, and communicating when the valve is opened with a chamber, into which two tubes lead from the cylinder; one of these tubes, curved upwards, is of larger bore than the other, which is curved downwards, and nearly touches the bottom of the chamber. The working is as follows:—The cup is filled with oil, and the screw valve opened, which allows of the contents entering the chamber; the valve is then screwed down. On steam being admitted above the piston a portion enters the chamber by the large tube, and pressing upon the oil, forces it through the smaller bored tube into the cylinder. *Patent completed.*

2393. W. S. Crane and S. J. Ellis. *Improved means of applying breaks to omnibuses and other four wheeled carriages.* Dated Sept. 25, 1861.

In checking horses, the effect is to raise the fore end and depress the rear end of the pole or shafts, and the inventors take advantage of the movement to apply breaks to the hind wheels. The invention consists in fitting a cranked lever or levers to the fore carriage or other convenient part, one arm of which lever bears against the rear end of the pole or shafts, and in connecting the other arm by means of a rod, rods or chains, to a disc or crank, connected also to a bar carrying break blocks. The action upon the checking of the horse or horses is to depress one arm of the lever, and bring forward the other, which, acting through the connections, brings the break blocks on the hind wheels; a spring releases the blocks and restores or allows of the cranked lever resuming its position as soon as the pole or shafts resume their ordinary position. *Patent abandoned.*

2394. S. Richardson and R. Irvine. *Improvements in treating gelatine.* Dated Sept. 25, 1861.

This consists in increasing the sizing properties and hardness of gelatine by the addition of one or more of the phosphates of lime and magnesia, silicates of potash, soda, lime and magnesia, and bichromate of potash. Also in treating the gelatine obtained from bones by muriatic acid with the sulphates, sulphites, phosphates, or silicates of the alkalies or weak sulphuric acid or aqueous sulphurous acid. *Patent abandoned.*

2395. A. V. Newton. *Improvements in the construction of and mode of working telegraphic apparatus.* (A communication.) Dated Sept. 25, 1861.

This invention is not described in detail apart from the drawings. *Patent completed.*

2396. T. Richardson. *Improvements in the manufacture of muriate of iron for the purification of coal gas.* Dated Sept. 25, 1861.

This consists in dissolving the burnt sulphur ore left as a waste product in the manufacture of sulphuric acid and in muriatic acid, and evaporating the solution to dryness, or in drying up the solution with saw dust, charcoal, small coke, gypsum, the waste burnt sulphur ore ground to powder, or any natural oxide of iron in powder, and in employing any of these mixtures with lime or magnesia in the usual way in the purification of coal gas. *Patent abandoned.*

2397. J. Vaughan. *Improvements in treating gas produced by blast furnaces in its passage from the blast furnaces to other furnaces, stoves, boilers, or other heating apparatus where gas may be employed.* Dated Sept. 25, 1861.

This consists in the use of a jet or jets of steam in connection with a regular supply of water. *Patent abandoned.*

2398. G. Russell. *Spring stretchers or bedsteads for camp, hospital, or general use.* Dated Sept. 26, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2399. D. J. Hertwood. *An improvement or improvements in nails.* Dated Sept. 26, 1861.

This consists in making nails having on their cylindrical or tapering bodies one or more ribs or longitudinay projections, the said ribs or projections being either straight or slightly twisted about the axis of the nail. *Patent abandoned.*

2100. T. Bentley. *Improvements in apparatus for beating eggs, and for mixing or agitating other fluids, compounds, or matters.* Dated Sept. 26, 1861.

This relates to the "Archimedian egg beater," and consists in forming the screw or spiral upon a tube to which the rotary beaters are attached, the tube and beaters being caused to revolve upon and around a fixed central axis, to the lower end of which a fixed frame with stationary arms is attached, which may intersect or surround the arms of the rotating beaters. *Patent completed.*

2401. H. Nunn. *Improvements in mangles.* Dated Sept. 26, 1861.

This relates to giving motion to the ordinary box mangle, and consists in improved arrangements of the mechanism employed for converting and transferring the continuous rotatory motion of the main driving axis into an alternating rectilinear to and fro movement of the travelling weight. *Patent abandoned.*

2402. J. Openshaw, W. Entwistle, and J. Lord. *Certain improvements in mules for spinning cotton, and other fibrous substances.* Dated Sept. 26, 1861.

The object here is the "doffing" or removal of the finished cops from the spindle upon which they have been wound, and is more particularly applicable to these mules in which "cop tubes" are used as a foundation for the cops. The improvement consist in the use of an inclined plane fitted to slide on a suitably-shaped bar extending the length of the spindle carriage from end to end in either direction. This inclined plane is drawn from the end of the carriage, passing close up to the spindles, its lower end or joint of the incline coming in contact with the underside of the flange of a short tubular ring, fitting loosely into the lower end of the cop tubes upon each spindle, and in its passage raising or lifting the rings together with the attached cops, until the cops are loose or the spindles ready for doffing, in which position they are held by the fallen rod and wire, which is brought to bear against them; the cops may then be easily doffed or removed in the usual manner. *Patent completed.*

2403. G. Caldwell, and J. Y. Miller. *Improvements in apparatus for dressing flour.* Dated Sept. 26, 1861.

This consists in combining with the well-known silk dressing machine a fan or other blowing apparatus arranged so as to pass a blast or current of air against or through the silk seive or dressing material, whereby the flour is cooled. *Patent abandoned.*

2404. J. H. Johnson. *Improvements in smoothing irons.* (A communication.) Dated Sept. 26, 1861.

This relates to smoothing irons having too faces, and made reversible, so that one face may be heated whilst the other is in use. By this invention the iron is heated by gas jets issuing from a pipe inside the iron, such pipe being secured to an end plate which allows the iron to be reversed, and enables it to be locked in its proper position by a spring catch. The jets are surmounted by a small chamber covered with wire gauze, whereby the production of smoke is prevented. A gas cock in connection with a flexible tube is soldered to the outside of the loose end plate above referred to; or a small nozzle only may be soldered thereon, over which the end of the flexible tube is passed and secured, the gas cock in that case being at the other end, or in any other convenient part of the tube. *Patent abandoned.*

2405. G. S. Robson. *Improvements in machinery or apparatus for raising or lowering heavy bodies.* Dated Sept. 26, 1861.

This relates to a direct-acting or gravitating crane capable of being worked either by steam, air, gas, or water, and consists in the employment of a cylinder of a length equal to the greatest lift required by the crane, in combination with a piston and counterweight, the piston working accurately within the cylinder, and the counterweight being heavier than the heaviest weight to be raised. *Patent completed.*

2406. G. T. Bousfield. *Improvements in knapsacks* (A communication.) Dated Sept. 26, 1861.

This consists in so suspending the knapsack from the shoulders that there shall be a space for the circulation of air between the back and the knapsack. And the invention also consists in replacing the ordinary shoulder strap with shoulder pads of a form and size suited to the form of the top of the man's shoulder. *Patent abandoned.*

2407. J. Tessier. *New means of saccharifying corn and cereal grasses.* Dated Sept. 26, 1861.

The inventor proposes to saccharify or give sweetness to barley, corn and other cereals; also all fecula and even inulin and cellulose. He mixes with the matter to be saccharified an animal matter, a little malted barley, or any other body capable of decomposing or attacking the gluten, and that at the commencement of the operation or decomposition. These substances remain in contact and dry for a longer or shorter time. He then steeps them several times in water at different degrees of temperature, so as to bring them nearly to, but not actually forming a starch, mixing and stirring them for from five to six hours, more or less, and when the fecula, the starch, &c., are discernible in the water, he raises the temperature to ebullition, retaining it thus until all the gluten is precipitated, and the liquid becomes limpid and sweet. He then filters on to the grains, and with hops makes beer; or he makes syrups as may be desired. *Patent abandoned.*

2408. M. F. A. Courtoise. *Improvements in kilns or ovens for baking or calcining limestone, chalk, cement, and other substances requiring such process.* Dated Sept. 26, 1861.

The outside of this kiln is either of a round, square, truncated, or pyramidal form, whilst the inside central calcining flue or oven is of an elliptical truncated conical shape; towards the bottom this flue is provided round part of its periphery with an arched gallery or colonnade of fire-bricks, which gallery serves as a fire-place in which the fuel is thrown from the outside through one or more suitable doors, whilst flame arising from the fuel passes between the columns to reach the limestone, &c., to be calcined in the central flue. In the interior of the brickwork round the gallery is a flue communicating with the outer air, which outer air in passing through the flue becomes suitably heated, and is projected on the fuel through a quantity of small openings with which the said flue is provided. The materials to be burned are introduced at the top of the kiln, and after having been sufficiently calcined, the same are raked out towards the bottom of the oven along a suitable incline. *Patent abandoned.*

2409. J. D. D. Passager. *Improvements in lamps for burning palm or other similar fat oil.* Dated Sept. 26, 1861.

This consists in having the oil vessel situated at a suitable distance above the burner, or the glass chimney, so that, by the heat evolved from the burner, the oil becomes liquified, and is allowed to reach the wick of the burner by running dawn a pipe connecting this latter with the oil vessel, a conical obturator serving for regulating the quantity of oil running down through the connecting pipe, whilst any excess of oil reaching the burner flows over the sides of this latter into a receiver situated underneath the burner in the interior of the lower part of the lamp. Arrangements are made for regulating the heat to be transmitted to the upper oil vessel. *Patent abandoned.*

2410. V. S. Lete. *Improvements in ærated or sparkling white wines.* Dated Sept. 26, 1861.

The patentee claims mixing with champagne or other white wines of the description known as ærated or sparkling wines, small pieces of leaf gold or leaf silver, or of both, the pieces being sufficiently light for allowing the same to be kept in suspension in the wine.

2411. R. Davis. *Improvements in churns.* Dated Sept 26, 1861.

Here the inventor constructs the churns of a cylindrical form of staves, but having their ends rebated, and which are received in circular grooves formed in the wooden plates or surfaces forming the ends of the churning vessel, into which they are driven and held by the pressure or hold so produced, or with the addition of pins, The end of the staves being rebated, a shoulder or shoulders is or are formed, which abut against the plane surfaces of the plates or ends, and thereby form a close joint. He disposes this vessel on feet formed by projections of the end plates beforementioned, or feet otherwise produced, and in position so that the axis is horizontal; this axis he passes through one end, and screws or otherwise fixes it to the dasher or beater, which he prefers to be of a plain piece of board with holes cut through it. The dasher fills as near as may be the sectional area of the chamber taken in a longitudinal direction, and revolves therein by motion communicated to the axis by a winch handle fixed thereon. An oval or other opening and suitable cover is made in the circular body at the upper part. *Patent abandoned.*

2412. W Clark. *Improvements in the manufacture of peat.* Dated Sept. 26, 1861.

The patentee states that he has found that certain defined combinations, however varied in their proportions, are the real causes of the inferiority of peat as a fuel, and the distinctive feature of this invention consists in destroying, so to speak, the constituents of the primary combination to prevent its forming as far as possible, or of so changing its nature that it shall no longer produce the same effects. This result is obtained without the aid of any new chemical combinations, as in the present invention it is only the purely chemical treatment of the product which is considered apart from the general treatment necessary for securing its success. *Patent completed.*

2413. R. Franklin and G. Bacchus. *A reversing back supporting nursing belt.* Dated Sept. 27, 1861.

This belt is made of webbing, attached to the back of which is a soft pad, having supporters of about three inches in length of cane or whalebone; the band is of such a length that, after passing round the waist of the child, it forms a handle for the nurse, the two ends being tied together by ribbon ends tacked to the webbing. *Patent abandoned.*

2414. F. W. Shields. *An improved method of applying wrought iron or steel plates to the covering and protection from the effects of shot and shell of forts, buildings, floating vessels and other constructions.* Dated Sept. 27, 1861.

Here the inventor proposes employing two, three, or more plates of wrought-iron or steel, of any thickness, overlapping or breaking joint with each other, and fastened together by tap screws screwed through some or all of the piles of plates, so as to form an independent connection of each plate with the other plates which lie under or over it. *Patent abandoned.*

2415. G. Smith. *Improvements applicable to gas meters.* Dated Sept. 27, 1861.

The patentee claims the construction and application to wet gas meters of syphon or water line regulating pipes, which are capable of being adjusted from the exterior of the meters, as described. *Patent completed.*

2416. J. Kimberley. *A new or improved machine, for mortising, tenoning, sawing, boring, drilling, and grooving wood.* Dated Sept. 27, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2417. D. McCallum. *Improved arrangement for filling and closing bottles and other vessels.* Dated Sept. 27, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2418. S. Rowsell. *Improvements in horse rakes.* Dated Sept. 27, 1861.

This consists in forming the beam or head of the rake of tubular iron, through which the teeth are fastened, thus combining strength with lightness; and in so arranging the bearing pieces that they take a bearing upon the ground behind their centres, by which means less weight is thrown upon the hands of the user. *Patent completed.*

2419. J. Waller. *An improved smoke-consuming stove.* Dated Sept. 27, 1861.

We cannot here give space to the voluminous details of this invention. *Patent abandoned.*

2420. J. S. Phillips. *Enabling mankind to fly through the air.* Dated Sept. 27, 1861.

Provisional protection has not been granted for this invention.

2421. G. J. Ganier and E. E. Collet. *Improvements in envelopes.* Dated Sept. 27, 1861.

These envelopes, which are adapted for advertising purposes, are formed by making the blank with a backpiece of nearly the same dimensions as the face of the envelope, and with side flaps which will fold over the back, and, being provided with overlapping ends, may be secured in the middle to prevent the back piece from being moved. *Patent abandoned.*

2422. J. A. Knight. *An improvement in steam pumping engines.* Dated Sept. 28, 1861.

This relates to a mode of arranging and working the valve gear of the steam cylinders of engines for pumping or forcing water. Two or more steam cylinders are arranged side by side, and the valve gear for working the valve of one cylinder is actuated by the movement of the piston of the other cylinder. The working of the pistons is so arranged that when one piston is at mid or half-stroke, the other shall be at the end of the stroke. *Patent completed.*

2423. W. N. Wilson. *Improvements in sewing machines.* Dated Sept. 28, 1861.

The details of the invention are voluminous, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2424. S. W. Rix. *New and improved methods of attaching or fixing woodwork, ironwork, fittings, or furniture, to walls, or buildings (and to which invention is given the style or title of Ackrill & Co's patent fixing bricks with wooden keys)* (A communication.) Dated Sept. 28, 1861.

This invention consists in the introduction of pieces of wood into cavities of appropriate forms constructed in certain of the bricks, stones, artificial stone, or composition material of any suitable kind used in the formation of a wall, so that the said pieces of wood are firmly fixed therein, appearing upon the surface of the brickwork or masonry. *Patent abandoned.*

2425. J. Reeves. *Improvements in electro-magnetic engines for obtaining and applying motive power.* Dated Sept. 28, 1861.

This consists in constructing helices with copper or other metal cylinders, and placing them one, two, or more in number as may be required in line with each other, leaving a space between the ends, and through these helices the patentee passes a metallic piston encircled with iron tubes placed at suitable distances apart from each other, which, when acted upon by the electric current, are put in motion, and the piston is thus caused to pass through the helices from one end to the other of the series and back again to a greater extent than it is possible to obtain by the piston passing through one helix alone. The piston is connected by a rod to a crank on a driving axis to give motion thereto. The advantage gained by this arrangement is that the length of the leverage or crank on the driving shaft of the machine can be varied to any extent desired, and the combined and successive action of a series of helices may be brought to bear thereon. *Patent completed.*

2426. D. Lane. *Improvements in apparatus whereby to regulate the passage or flow of gas, water, and other fluids.* Dated Sept. 28, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2427. J. Moiroux. *A portable spring bedstead and mattrass movable or fixed.* Dated Sept. 28, 1851.

Provisional protection has not been allowed for this invention.

2428. T. Potts. *An improvement in clasps for books, portfolios, desks, and other similar articles.* Dated Sept. 28, 1861.

This invention is intended to apply chiefly to foreign books and Bibles, though it is equally applicable to all books and other like articles to which clasps are fitted. The invention consists in the forming the clasps with a spring, and with a spring catch, in such manner that, on the spring catch being liberated by pressure on a knob or otherwise, the spring shall cause the clasp to fly up or out from the catch. The spring also has the effect of preventing the clasp from falling on the edges of the leaves when fitted to a book, or from falling below the level at which the clasp is fitted. *Patent abandoned.*

2429. M. Sheiler. *Improvements in telegraphs.* Dated Sept. 28, 1861.

This relates, 1, to dial instruments, and consists in a far less number of currents and motions being required for carrying the hands round the dial than in any other instrument hitherto used. 2. In the combination of the dial telegraph, with a mechanism for printing letters and other marks. 3. In improvements in the Morse and other mark printing instruments, whereby the various marks representing the letters of the alphabet and other marks can be produced or printed with greater rapidity. *Patent completed.*

2430. C. Comer. *Improvements in the manufacture of metal tubes for bedsteads and other purposes, and in the machinery employed therein.* Dated Sept. 28, 1861.

This relates to the former patent, dated 5th April, 1861 (No. 836), and consists in bending sheets of metal over a conical roller in which is a groove; one edge of the metal sheet is placed in this groove, and when the roller is turned round, the remainder of the sheet of metal is bent into a tapered tube. The edges are then brazed or otherwise secured together. The end of the conical roller is raised to allow the tube to be taken off. *Patent abandoned.*

2431. T. Smith. *A military steel umbrella.* Dated Sept. 30, 1861.

This consists of a hollow steel rod or tube, round, oval, or square, with two grooves cut into it to receive a spring to fasten the umbrella, either up or down, with a steel dagger at the end, with a guard cover which screws over it, and which can be removed at pleasure. There are also steel ribs, elastic steel joints, steel stretchers, with shoulder heads enclosed in a brass or metal box, in place of the ordinary umbrella slide. The box consists of two parts which screw together and contain eight holes or chambers, for the stretched heads to rest in, and corresponding grooves outside. *Patent completed.*

2432. E. Funnell. *A self-acting alarum, which can be fixed on tenders, guards' compartments, or other parts of railway trains for preventing collisions.* Dated Sept. 30, 1861.

This consists in a self-acting alarum, actuated by certain suitably arranged levers, wheels, and cranks for preventing collisions on railways. The invention is not described in detail apart from the drawings. *Patent abandoned.*

2433. J. S. Bickford and G. Smith. *Improvements in the manufacture of safety fuzes.* Dated Sept. 30, 1861.

Here the small metal tube filled with gunpowder is enclosed in threads of yarn and countered, and if necessary, varnished in the manner of the ordinary Bickford's fuze. *Patent abandoned.*

2434. B. G. George. *Improvements in mounting of tables, show bills, prints, photographs and drawings, and of producing embossed ornamentation applicable to various purposes.* Dated Sept. 30, 1861.

This consists of making a slab of plaster of paris, papier mâché, or composition of mineral and vegetable substances, of the shape and size required, upon which the patentee mounts the show bill, &c., securing it to the plaster or composition back of cement. A fancy or ornamental border may be produced by casting plaster of paris in suitable moulds. *Patent completed.*

2435. J. Lesh. *Improvements in mashing attemperators.* Dated Sept. 30, 1861.

The object here is to avoid "raw worts," and this object is effected by an arrangement of attemperator which raises the temperature of the mash to any required heat, and retains it at such temperature as long as may be required, and in a manner which produces no damage to the mash. We cannot here quote the details of the invention. *Patent completed.*

2436. C. H. Pennycook. *Improvements in chimney hoods and ventilators.* Dated Sept. 30, 1861.

This apparatus arranged as for a chimney hood consists of a cylindrical shed, formed or divided internally, so as to present one or more helical or screw shaped passages, and mounted upon an upright spindle, so as to revolve as freely as possible. The lower edge of the cylindrical shed dips down into an annular trough, formed in the bottom or part by which the apparatus is fixed upon the chimney or vent, and to which the spindle is fixed. This trough being filled with water, which will be continually replenished by rain, forms a liquid joint, and prevents interference with the internal current at that part. A cap is attached to the drum or cylinder at a slight distance above it, the smoke having free egress laterally or radially between the two. The revolving cylinder and the cap are both formed with external pocket-like vanes, having the sides inclined, but with no openings through into the interior. The slightest external air current, by acting on the vanes, causes the hood to revolve, and the vanes being set in a suitable direction relatively to the internal screw, the latter in turning exerts an upward drawing or propelling action on the smoke. *Patent abandoned.*

2437. W. J. Christy. *An improved method of mailing ships of war.* Dated Sept. 30, 1861.

The mail or armour is formed of a series of wrought-iron belts or girdles placed one above another in horizontal planes, and separated from each other by beams of wood placed in the intervening spaces. *Patent abandoned.*

2438. E. Roche. *Medicinal preparation applicable as a lotion and for internal application.* Dated Sept. 30, 1861.

This medicinal preparation is beneficial for rheumatism, neuralgia, gout, stomach, chest, and liver complaints, and it is prepared from the roots of the pomegranate and date trees. This extract is macerated in brandy. *Patent abandoned.*

2439. H. Hickman. *An improvement or improvements in protecting the locks and sights of fire-arms.* Dated Sept. 30, 1861.

This invention consists in providing a protective cover or cap for the locks and sights of fire-arms, more particularly for rifles and sporting guns, which cover or cap is of such form and material as to afford a thorough waterproof protection, readily applied, and as readily removed, whilst at the same time, its form admits of being conveniently carried in the pocket when it is not in use. *Patent abandoned.*

2440. F. Walton and R. Beard. *Improvements in the manufacture of varnishes applicable to the waterproofing and coating of fabrics and other uses.* Dated Sept. 30, 1861.

This refers to a previous patent, dated 27th January, 1860 (No. 209), which, amongst other matters, relates to manufacturing varnishes by dissolving in volatile solvents drying oils oxydised or converted into resinous bodies, using therewith gums or gum resins. The patentees, according to this invention, combine with the converted drying oil, coal, naptha, benzole, &c., together with gum or gum resins, soluble in such solvents as Burgundy pitch, gum copal, gum kuri and others. *Patent completed.*

2441. P. A. F. Bonafuy. *The preparation and application of certain new hemostatic and antiseptic agents.* Dated Sept. 30, 1861.

This invention relates to the manufacture and application as hemostatic agents of alkalini, phenates, and salts, obtained by means of mineral and vegetable essential oils, soluble in caustic, potash or soda. By this invention the patentee obtains new hemostatic agents superior to any hitherto known, by using alkaline salts, produced either by phenic acid (no matter the nature of the substances from which this acid is derived), or by acid oils saponifiable and soluble in caustic soda, or potash, derived from vegetable and mineral essential oils, especially coal, peat, wood, and ligneous oils, acid oils, which, when not actually phenic acid, are analogous or homologous (such as creosote), and possess, like phenic acid, the same hemostatic properties. *Patent completed.*

2442. W. E. Mathews. *Conveying a line or other medium of communication from a ship or vessel, for the purpose of obtaining relief or assistance in case of shipwreck, or for any other purpose to which the invention may apply.* Dated Oct. 1, 1861.

This consists essentially in the use of a suitably-constructed frame, in connection with two gutta-percha or india-rubber balls, intended to be acted upon by the wind and waves. *Patent completed.*

2443. J. A. Knight. *Improvements in the manufacture of boots and shoes.* Dated Oct. 1, 1861.

This consists in rivetting the external sole to the upper, and to the insole, by flat pointed rivets that are alternately clenched in opposite directions and are made in a staple shape, and extend across the sole at the shank and heel portion of it. *Patent abandoned.*

2444. O. O. Lesourd. *Improvements in joining pipes and tubes, or in forming or securing the joints thereof.* (A communication.) Dated Oct. 1, 1861.

Here a box is formed or fitted over the joint or ends of the pipes to be joined, into which box is introduced a cement, after which the box is sometimes removed, and sometimes left on. *Patent completed.*

2445. R. Nightingale. *Improvements in markers' butts or mantlets.* Dated Oct. 1, 1861.

One important feature in this invention consists in applying at the upper parts of a marker's butt or mantlet a bullet proof camera, so arranged that it may throw an image of the target into a table or surface below, on which is placed properly ruled or prepared paper, corresponding with the divided surface of the target, so that the mark made by each bullet on striking the target will be imaged in its precise position on the ruled or divided paper, and to be there marked or indicated by the marker with ink, together with the number of the shot. *Patent abandoned.*

2446. J. W. Scott. *An improvement in gun wads.* Dated Oct. 1, 1861.

The object of this invention is to obtain a gun wad which shall not be easily compressible and absorb a portion of the effect of the powder, and which shall at the same time tend to keep the barrel clean and the shot from spreading. The invention consists in manufacturing gun wads from leather, by preference sole butt leather compressed and fashioned into suitable forms for the purpose. The inventor forms the under wad, or that which is to be placed on the powder, dished or concave on one side, and intends the concave side to be placed uppermost in the gun while the upper wad need only be in the form of a disc. *Patent abandoned.*

2447. J. W. Scott. *Improvements in tools for the manufacture of leather, and other rings, washers, and laces.* Dated Oct. 1, 1861.

This invention was described and illustrated in our last Number. *Patent completed.*

2448. N. H. Payne. *Improvements in apparatus for preventing the loss of and facilitating the recovery of ships' moorings, and submerged property in general.* Dated Oct. 1, 1861.

Here the inventor adopts a buoy to float under the surface of the water, which is free from all the objections to which the surface buoy is subject. This buoy which the patentee denominates a "submarine recovery buoy," is attached to a short piece of chain, by which it is shackled on to the ships' cable in the place of the ordinary buoy rope; the buoy has three hooks (more or less) on its circumference, and being of sufficient buoyancy to float itself and a portion of the ships' cable, it will consequently remain floating near the surface of the anchorage ground in a position suitable to be caught by a sweeping rope when required. For convenience and expedition in finding the exact spot, he also attaches the ordinary rope and surface buoy, as usual, and if this should disappear, the cable may be still easily removed. *Patent completed.*

2449. W. S. Hagg. *Improvements in rendering columns, girders, doors, shutters, and other parts of buildings fireproof.* Dated Oct. 1, 1861.

This consists in casing and enclosing such parts in fireproof bricks, or other forms of clay or analogous fire-proof material, moulded and formed to suit the particular object to be enclosed. *Patent completed.*

2450. J. Harsford. *Certain improvements in steam-engines, and in valves for steam and other fluids.* Dated Oct. 2, 1861.

This consists in dispensing with the usual eccentric for working the slide or other admission valve, and in working such valves by a double lever, connected to the piston-rod of the steam cylinder, and to the spindle of the valve. The improvements in valves consist in fixing a taper plug to a screwed spindle, which spindle works through a stuffing-box. When the spindle is turned round to open or close the valve, the plug is lifted partly out of or pressed into the socket, and as the plug is fixed to the spindle, the opening or closing of the valve turns the plug round or partly round, and thus removes the impurities adhering to it. *Patent abandoned.*

2451. A. D. Bishop. *Improvements in pumps.* Dated Oct. 2, 1861.

This consists in diminishing the power requisite for pumping liquids, which the inventor proposes to do by a vacuum chamber; and also in filtering or purifying the liquid raised; and also in a method of separating the sediment from the liquid previous to its entering the pump, which improvements can be worked separately or together. *Patent abandoned.*

2452. D. Rerolle. *An improved steam digging machine.* Dated Oct. 2, 1861.

The locomotive parts of this machine consist, 1, in the use of motive wheels. 2. In the use of a front train of wheels of large diameter, which, by two axles, one fixed, the other oscillating, permits of easily giving the required direction to the machine. The apparatus for digging consists of a wheel with teeth, which, turning from below upwards, raises the earth, and throws it off so as to allow the passage of the machine. This wheel is put in motion by another wheel with rollers, which catches directly with its teeth; it is usually furnished with scrapers. The apparatus for carrying the earth is sometimes not used. *Patent abandoned.*

2453. *Improvements in fire-arms.* Dated Oct. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2454. A. Fowler. *Improvements in buffers of railway carriages.* Dated Oct. 2, 1861.

In other to prevent the buffer heads of the buffer apparatus of railway carriages rising or falling in respect to each other, tubular shields or guards are applied to the buffer heads of one carriage, into which the buffer head of the next carriage may slide or pass freely, and so that, when a buffer head of one carriage has entered the tubular shield or guard carried by the buffer heads of the two carriages, the carriages will be prevented rising or falling to different levels. It is preferred to construct these tubular shells or guards each in two halves, and to put them together by projecting longitudinal flanges at the top and bottom, in order thus to obtain strength. *Patent abandoned.*

2455. J. Davis and T. Evans. *Improvements in the construction of engines to be worked by steam, air, or gases.* Dated Oct. 2, 1861.

This relates to the construction of those engines where the admission of the steam is regulated by the oscillation of the cylinder, and consists in the peculiar form and arrangement of the valve, which opens and closes the steam and exhaust ports, and also in the peculiar mechanism by which the motion of the valve is regulated. The details of the invention are too voluminous to be quoted here. *Patent completed.*

2456. W. Maltby. *Improvements in the manufacture of starch and starch gum.* Dated Oct. 2, 1861.

This consists in subjecting the rice to the action of certain chemicals, and to sundry washings and strainings, the details of which we cannot with advantage produce here. *Patent completed.*

2457. J. A. Coffey. *Improvements in motive power engines.* Dated Oct. 2, 1861.

Here the inventor has a central pipe or duct of any suitable kind, from which radiate other pipes or ducts, and the other ends thereof he has angled stopped pipes, cylinders, or ducts, and at or near the junction of the radial pipes or ducts and those last named are openings (one to each radial and its angled pipe or cylinder aforesaid), and these openings are made to slide air-tight against a fixed annulus, so that upon steam, air, or other fluid being admitted into the central pipe or duct and filling the radial pipe or duct, it will exert pressure against the said annulus so as to cause rotation. The central pipe or duct and the attachments aforesaid are constructed free to turn in the centre. *Patent abandoned.*

2458. R. A. Brooman. *Improvements in the manufacture of figured coloured fabrics and in machinery employed therein.* (A communication.) Dated Oct. 2, 1861.

The first part of this invention consists of improvements in the dipping boxes (boites plongeantes), whereby India shawls and similar articles can be made much more expeditiously and economically than heretofore. By this improved process the different threads instead of passing above and below across the whole shawl are used only where the figure appears; a great economy of material is thus effected, it is the same also in the case of stripes. The dipping box has already been employed in the manufacture of embroidery to carry the weft of a certain distance of the fabric. But in this invention this box is applied to effect another purpose, namely, to work or unite together the warp threads and embroidering threads, by crossing the threads or raised threads (armures), according to the different intercrossings of the threads used in different tissues, such as serges, satins, cloth, and the like. Thus a new result is obtained, namely, any kind of raised work may be produced upon the figures, and especially the twill upon woven shawls. The second part of the invention consists in the manufacture of India fabrics by two boxes. The invention is not described in detail apart from the drawings. *Patent completed.*

2459. W. Tooerson and S. Stather. *Improvements in hydraulic presses.* Dated Oct. 2, 1861.

This invention relates to those presses in which one large and two small pumps are employed for working a pair of presses or double press. And the invention consists in fitting stop valves commanded by handles accessible to the attendant, whereby communication can be opened with both or either of the presses as required. *Patent completed.*

2460. E. Brevitt. *Improvements in machinery employed in cutting hollow and solid corks.* Dated Oct. 2, 1861.

According to this invention, the inventor arranges the bed on which the strip of cork to be operated on rests and makes it adjustable by mean of a slot and screw in the upright which supports it, so that, without waiting to look, the workman presents the cork to the cutter at a fixed distance from the best or belly side of the cork, this part of the invention applies to solid corks, but in cutting hollow corks it is necessary to provide for the lateral position of the piercings of the cutter so that enough and no more cork is left between than sufficient to form the hollow corks of the required substance, for this purpose he proposes to provide a guide adjusted by slot and screw parallel with the bed, and by means of the guide the workman determines the intervals at which it is necessary to push the strip of cork towards the cutter. In presenting the strip of cork a second time to the cutter, this invention is directed to keeping the edge of the circular cutter truly concentric with the first cut, and for this purpose he arranges a mandril which is pressed forward at proper intervals through a rest with the same centre as the first cut. *Patent completed.*

2461. E. Brevitt. *Improvements in the manufacture of boxes or cases, and in machinery employed therein.* Dated Oct. 2, 1861.

This invention is intended chiefly to apply to the making of rough cases or boxes, and consists in taking the wood after being sawn to the required sizes, and drilling holes for the reception of the nails. The machinery consists of movable adjustable metal frames and fences upon which the wood and the cases in their various stages of manufacture are placed, and held while being nailed together. *Patent completed.*

2463. J. C. Dickinson. *Certain improvements in steam-engines.* Dated Oct. 23, 1861.

Here the high-pressure and low-pressure cylinders are placed near to each other, and, by preference, they are cast together; the piston rods of both the cylinders are connected to a beam, to which are also connected the plungers of the air pump and the force pump, the connecting rod, by which motion is communicated to the crank shaft, is also connected to the beam. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Dec. 27, 1861.

3241. P. A. le C. de F. Moreau, 1 South-street, Finsbury. Improvements in treating fatty and resinous bodies, either in a neutral or acid state. (A communication.)

Dated Jan. 30, 1862.

249. W. Davies, Elizabeth-place, Old Bethnal-green-road, pattern maker. Improvements in apparatus for cutting corks and bungs.

Dated Feb. 6, 1862.

311. A. C. Bamlett, Middleton Tyas, near Richmond, farmer. Improvements in reaping and mowing machines.

Dated Feb. 15, 1862.

415. A. H. Harrison, 16 Park-place, Highbury. An improved under-garment for gentlemen and ladies' wear.

Dated Feb. 22, 1862.

478. J. P. D. Camp, 100 Fleet-street. Improvements in arrangement of valves for steam and other engines, and in the means of operating the same. (A communication.)

Dated Feb. 25, 1862.

507. C. Minasi, 3 St. James's-terrace, Kentish-town-road, professor of music. Improvements in cartridges, and in apparatus for facilitating the proper aiming with fire arms.

Dated Feb. 27, 1862.

533. T. Adams, Deptford, engineer. Improved arrangements for effecting an equilibrium of the steam pressure upon valves, the said arrangements being also applicable for effecting equilibrium of fluid or gaseous pressure upon other valves.

Dated March 8, 1862.

625. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in machinery or apparatus for cleaning cotton from seeds.

Dated March 11, 1862.

656. O. Kerautret and J. Kerautret, 15 Passage des Petites Ecuries, Paris. Improvements in the construction and ornamentation of buildings, by the use of which hewn stone and faced bricks are dispensed with in some parts thereof.

659. T. B. Wilson, Queen's Ferry, Flint, and W. Wilson, Preston, managers. Improvements in means or apparatus for the splitting of cane or other fibrous substance.

Dated March 12, 1862.

665. A. J. Russell, Edinburgh, clerk. Improvements in the arrangement of the electric conductors for submarine telegraphs. (A communication.)

676. F. Tolhausen, C.E., 17 Rue du Faubourg Montmartre, Paris. An improved kind of spinning or humming top. (A communication.)

Dated March 15, 1862.

718. J. Hunter, Coltness Iron Works, Cambusnethan, Lanark, ironmaster, and R. Scott, engineer. Improvements in reaping machines.

Dated March 17, 1861.

735. B. Todd, Bissoe and Perran Smelting Works, near Falmouth. Improvements in the manufacture of antimony and the oxide of antimony.

Dated March 20, 1862.

773. B. Samuelson, Banbury, agricultural engineer. Improvements in chain harrows.

775. A. Hill, Cheddar, stay manufacturer. An improved fastening for stays.

777. E. Smith, Sheffield, sculptor. Improvements in means or apparatus for cutting stone, wood, and other material, which improvements are also applicable to modelling in plastic material.

779. W. Baddeley, Angel-terrace, Islington, C.E. An improved method of preparing tobacco for smoking, and in the apparatus to be used for that purpose. (A communication.)

781. J. G. Thompson, Porchester-place, gentleman. Improvements in pianofortes, organs, harmoniums, and other instruments having key boards.

Dated March 21, 1862.

783. R. Kay, Castleton Print works, Blue Pits, Lancaster, calico printer. Certain improvements in the method of printing calico and other surfaces, and in apparatus connected therewith.

785. J. Newall, Bury, railway carriage builder. Improvements in supplying gas to railway carriages, stations, steamboats, and other vessels, omnibuses, or other carriages, at any required pressure, and in apparatus connected therewith

686. J. M. Hart, 76 Cheapside, and R. Lavender, 332 Goswell-road. Improvements in means for generating steam.

787. J. Fawcett, Wakefield, corn and fulling miller. Improvements in the manufacture of soap, particularly applicable to the scouring, cleansing, and fulling of woollen or other cloths.

789. B. H. Mathew, St. James', lieutenant Royal Bombay Engineers. Improvements in fire-arms and in cartridges.

791. J. and W. Warbrick, machine makers, and A. Travis, foreman, Furnace-hill Iron Works, Dukinfield. Improvements in engines for carding cotton and other fibrous materials.

Dated March 22, 1862.

793. D. Abercrombie, mechanic, Glasgow. Improvements in power looms.

795. T. Fontenay, Grenoble, France, C.E. Improvements in smoke consuming furnaces.

797. E. Lord, Todmorden, York, machine maker. Improvements in certain machines for preparing cotton and other fibrous substances.

799. R. Gladstone, Court-Hey, Broad-green, Lancaster, merchant. Certain improvements in tilting or tipping waggons.

801. J. H. Tuck, 35 Cannon-street, City. Improvements in the manufacture of flexible valves.

803. T. M. Smith, High-street, Kensington. Improvements in the manufacture of candles.

805. W. Holiday, Union Foundry, Bradford, York, engineer. Improvements in the manufacture of press plates.

Dated March 24, 1862.

808. J. H. Brierley, Beech-hill Mills, Halifax. An improved clasp or fastener for reversible belts, bands, or straps.

809. J. Clarke, Shiffnal, Salop, manufacturer. An improvement or improvements in carriage axles.

811. S. E. Turner, Birkenhead. An improved apparatus for burning a mixture of inflammable gas and air.

812. C. M. Roullier, Paris, manufacturer. Improvements in flat cables or chains.

813. B. Fleet, East-street, Walworth, soda water manufacturer. Improvements in apparatus for manufacturing and bottling soda water.

815. E. Morewood, Stratford, and A. Whytock, Little St. Andrew-street, St. Martin's-lane. Improvements in the process of coating metals, and in the apparatus employed.

816. W. Henson, Great Alfred-street, Nottingham, engineer. Improvements in knitting machinery.

Dated March 25, 1861.

819. E. Molyneux, Jun., Seaview, Enniskerry, Wicklow. Improvements in air, gas, and vapour engines.

820. A. H. Renton, 14 Royal Avenue-terrace, Chelsea, C.E., and E. Cottam, Pimlico, engineer. Improvements in apparatus for steering ships.

821. W. Beaumont, Lieutenant, and J. W. Edge, gun and rifle manufacturer. Improvements in sights for rifles.

823. A. M. Silber, Wood-street, Merchant. An improved fastening for purses, pocket books, bags, and other articles. (A communication.)

825. E. Morewood, Stratford, and A. Whytock, Little St. Andrew-street, St. Martin's-lane. Improvements in the manufacture or shaping of iron or other material.

826. W. Palmer, Sutton-street, Clerkenwell. Improvements in lamps.

827. C. Culling, Downham Market, Norfolk, gunmaker. Improvements in fire-arms.

829. J. T. Loft, Berwick-street, Pimlico, architect. Improved machinery for covering strips of metal and wire.

Dated March 26, 1862.

831. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in apparatus for cleaning tubes and flues of steam boilers and similar conduits. (A communication.)

833. J. Parker, Huddersfield, engineer. Improvements in steam engines, and in apparatus connected therewith. (A communication.)

835. H. Nunn, Chelsea, whitesmith. Improvements in the construction of mangles.

837. J. Boothman, Gisburn, near Skipton, farmer. Improvements in beehives and apparatus connected therewith.

839. H. Carr, 4 Victoria-street, Westminster, C.E. Improvements in applying lubricating fluids to the journals of railway carriages and locomotive engines.

Dated March 27, 1862.

842. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. An improved process of and apparatus for separating the fibres of wood, flax, hemp, and other vegetable substances, and extracting the colouring matters therefrom. (A communication.)

852. J. L. H. Clemence, Comtesse de V. de Cornellian, Paris. Improvements in treating open cocoons of silkworms, and in converting the waste resulting therefrom into paper.

Dated March 28, 1862.

862. J. Jones, Mersey Bank, Warrington, engineer. Improvements in apparatus for raising and forcing liquids.

868. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in chaff cutters. (A communication.)

870. R. Luminski, 183 and 185 City-road, stick manufacturer. An improved method of jointing crutch hooks on umbrellas or walking canes.

Dated March 29, 1862.

872. J. Boucher, 3 Surrey Villas, Camberwell New-road, gentleman. Improvements in rifled ordnance and fire-arms, and in the projectiles to be used therewith.

878. W. Glass, 37 Princes-street, Stamford-street. Improvements in the treatment of sulphuret of antimony and in obtaining products therefrom.

880. W. Paterson, Glasgow, manufacturing chemist. Improvements in the manufacture of iodine.

882. J. Baker, Devonshire-grove, Old Kent-road, manufacturing cook and confectioner. Improved alimentary preparations.

884. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in carding engines.

Dated March 31, 1862.

886. J. Clinton, 35 Percy-street, Tottenham-court-road, professor of music. Improvements in flutes.

888. J. Jordan, Liverpool, engineer and surveyor. Improvements in the construction of armour plated vessels or other like structures.

892. W. H. Hook, Walworth. Improvements in folding envelopes and paper, and in machinery or apparatus employed therein.

894. W. B. Lord, Plymouth, veterinary surgeon, Royal Artillery, and F. H. Gilbart, Brixton, gentleman. An improved hame slip for suddenly releasing horses and other cattle from their harness, also applicable for releasing heavy bodies or weights.

896. R. Burley, Lower Thames-street, iron and brass founder. An improved material for forming or lining the bearings of axles and shafts, and other rubbing parts of machinery.

898. R. Nightingale, Maldon, Essex, artist. Improvements in markers, butts, or mantelets.

900. J. Harding, Beeston Manor Iron and Coal Works, Leeds, engineer and iron master. Improvements in the application of the waste heat arising from coke ovens for heating air for blast furnaces, also for calcining ironstone and other minerals, and for heating and smelting iron.

909. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in rotatory engines. (A communication.)

904. W. Mc. I. Cranstone, 58 King William-street, City. Improvements in machinery for cutting corn and other crops. (A communication.)

Dated April 1, 1862.

908. W. Clark, 53 Chancery-lane, engineer. Improvements in the manufacture of manure. (A communication.)

912. F. Knudsen, 33 and 34 Cockspur-street, Charing-cross. Improvements in chronometers.

914. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in machinery or apparatus for spinning cotton and other fibrous substances. (A communication.)

916. H. W. Whitehead, machine and tool maker, and G. Bray, Leeds, carding engineer. Improvements in machinery for carding wool and other fibrous substances.

918. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in mules for spinning and doubling.

920. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in machinery or apparatus used for applying motive power derived from bullocks, horses, or other animals.

Dated April 2, 1862.

922. W. C. Harrison, 13 Sutherland-place, Pimlico, C.E., and H. J. Standly, 20 Cockspur-street, Westminster, esquire. An instrument or tool for boring or drilling holes in slate or other rock.

924. Reverend G. Scratton, Stickney, Lincoln, clerk. Improvements in shades or blinds for windows.

926. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in memorandum, pocket, and other books, and in pencil and pen holders to be used therewith. (A communication.)

928. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in bits for training or subduing vicious horses and breaking colts. (A communication.)

930. B. Blackburn, York-buildings, Adelphi. Improvements in apparatus for lubricating locomotive and other axles.

932. T. Moore, 33 Regent-circus, Piccadilly. Improvements in winding apparatus, especially applicable to fishing lines, nets, and log-lines, and in leaders or travellers to be used therewith, which leaders or travellers are also applicable to working ships' sails, and other useful purposes.

936. W. Clark, 53 Chancery lane, engineer. Improvements in the manufacture of carbonic acid. (A communication.)

Dated April 3, 1862.

940. G. Bower, Ashton-under-Lyne, Lancaster, iron-moulder, and J. Qualter, Dukinfield Chester, blacksmith. Certain improvements in metallic pistons.

942. G. Hunter, Coleford, Gloucester, engineer. Improvements in machinery and tools for cutting, sawing, and planing stone, marble, and slate.

944. W. Kemp, 20 Spital-square, and T. Cowley, Hart's-lane, Bethnal-green. Improvements in the manufacture of silk pile velvet.

946. D. Wilson, Wandsworth Common, and E. A. Cowper, 35A Great George-street, Westminster. Improvements in presses for pressing cotton, fibrous materials, and hay.

948. A. Mann, Tottenham. Improvements in photographic apparatus.

950. H. T. Hassall, Birmingham, manufacturer, and M. Burke, Liverpool, cabinet maker. Improvements in reclining or invalids' chairs, and in swinging or ships' chairs.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

3022. J. Wakenell. Invalid bedsteads.

3034. G. Ralston. Ships. (A communication.)

3026. R. A. Rust. Pianofortes.

3048. J. Knowelden. Pumps.

3057. A. Woodward, R. Woodward, and W. Woodward. Steam-engines.

3062. F. Vetterlin. Breech-loading ordnance.

3065. H. G. Schramm. Engines and pumps. (Partly a communication.)

3069. R. Jolley. Heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases.

3072. W. N. Hutchinson. Projectiles and ordnance.

3075. T. Mellodew, C. W. Kesselmeyer, and J. M. Worrall. Dyeing and printing.

3076. B. M. Gerland. Copper.

3090. H. Alexander. Gas burners.

3099. D. Vogl. Garments.

3100. J. W. Agnew. Electro-voltaic pocket battery. (Partly a communication.)

3109. J. Potter. Jointing or connecting telegraph wires.

3115. W. E. Wiley. Pencil-cases and holders.

3117. W. S. Longridge. Railway engines and tyres.

3118. A. Tonnar. Drying and cleansing malt.

3129. J. W. Friend. Registering the depth and flow of spirits.

3137. H. Appleby and H. Harrison. Brooms and brushes.

3155. D. Chalmers. Looms.

3158. C. Baumann. Buttons.

3162. R. Shaw. Carding engines.

3181. T. Bourne. Cotton gins. (A communication.)

3199. E. E. Pereau. Revivifying woollen cloths. (A communication.)

3212. W. Kempe. Gig mills.

3215. L. R. Bodmer. Manufacture of sacks, knapsacks, and mattress cases. (A communication.)

3241. P. A. le C. de Fontainemoreau. Treating fatty and resinous bodies. (A communication.)

3249. E. Lord. Preparing fibrous substances.

3251. M. Henry. Fire-arms. (A communication.)

3257. W. E. Newton. Manufacture of sugar. (A communication.)

3269. W. H. Bailey. Sewing machines.

37. A. Warner. Purifying coal gas.

44. F. Shaw. Stopping railway trains.

67. R. A. Brooman. Carburetting and burning gas. (A communication.)

151. J. A. Knight. Permanent way. (A communication.)

240. W. E. Newton. Journals. (A communication.)

311. A. C. Bartlett. Reaping and mowing.

364. G. J. Aman. Envelopes or bags.

392. E. Green and J. Newman. Buttons.

472. J. Kirkwood. Weaving.

466. J. P. D. Camp. Valves. (A communication.)

667. W. H. Latham. Perforating and numbering.

668. W. H. Latham and F. C. W. Latham. Cutting paper.

687. J. Wandsworth. Heels for boots and shoes.

737. W. Barber. Hats.

822. A. Fryer. Manufacture of sugar.

829 J. T. Loft. Covering strips of metal and wire.

832. J. Wilson. Hotpressing.

844. W. Greenway. Bolts.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated April 4, 1862.

2565. C. Wynants.
2567. W. Ross.
2568. J. Gilbert.
2580. W. Smith.
2586. C. De Groote.
2591. W. Croome.
2598. C. H. Holt.
2599. W. Streather.
2608. C. Cheyne and T. B. Moseley.
2609. R. Mushet.
2610. T. Lepeinteur.
2635. J. Toward.
2637. R. Mushet.
2649. J. F. V. Delfry.
2650. A. Morel.
2684. W. Robertson and J. M. Hetherington.
2728. A. Topham, J. Topham, and J. Topham.
3101. M. A. F. Mennons.
23. H. Eschwege.
81. T. Ramsay.
138. W. L. Winans.
273. J. Hill.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

663. J. McKinnell.
789. J. H. Johnson.
805. J. L. Norton.
816. J. Templeton.
823. G. Turner.
890. J. Hawkins.
899. R. Wappenstein.
921. R. A. Brooman.
922. S. Tatton.
932. J. L. Stevens.
924. W. A. Martin and J. Purdie.
938. J. Beattie.
951. H. A. Silver.
960. H. Harrison.
961. J. Sidebottom.
997. L. P. Porter.
1030. J. H. Johnson.
1100. D. Moore.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending April 12, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		
2185	0 10	2195	0 10	2206	0 10	2216	0 3	2226	0 3	[illegible]	[illegible]
2186	0 6	2196	0 3	2207	0 10	2217	0 3	2227	0 3	[illegible]	[illegible]
2187	0 6	2197	0 4	2208	0 7	2218	0 3	2228	0 [illegible]	[illegible]	[illegible]
2188	0 7	2198	0 5	2209	0 10	2219	0 3	2229	0 10	[illegible]	[illegible]
2189	1 3	2199	0 3	2210	0 3	2220	0 10	2230	0 3	[illegible]	[illegible]
2190	0 5	2200	0 3	2211	2 1	2221	0 3	2231	0 6	[illegible]	[illegible]
2191	0 3	2201	0 10	2212	0 3	2222	0 6	2232	0 6	[illegible]	[illegible]
2192	1 4	2202	0 10	2213	0 6	2223	0 9	2233	0 3	[illegible]	[illegible]
2193	0 7	2203	1 2	2214	0 3	2224	0 9	2234	0 10		
2194	0 3	2205	0 3	2215	0 3	3225	0 7	2235	0 6		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, April 10, 1862.

		£ s. d.		£ s. d.
IRON:				
Rails in Wales and North of England	pr. ton	5 0 0	to	5 5 0
Welsh Bars, in Wales	"	0 0 0	"	5 7 6
Staf. Bars, at the Works	"	6 10 0	"	7 5 0
" Hoops	"	7 10 0	"	8 0 0
" Sheets, Singles	"	8 0 0	"	9 0 0
" Nail Rods	"	5 15 0	"	6 10 0
" Boiler Plates	"	8 0 0	"	9 10 0
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 11 3	"	0 0 0
Do. No. 1, Good Brands	"	2 11 6	"	2 15 0
Scotch Bars	"	7 5 0	"	7 15 0
Swedish Bars, in London	"	10 10 0	"	11 0 0
COPPER:				
Sheet and Sheathing	per lb.	0 0 11	"	0 0 0
Tough Cake and Tile	pr. ton	98 0 0	"	0 0 0
Best Selected	"	101 0 0	"	0 0 0
Australian	"	99 0 0	"	0 0 0
South American	"	0 0 0	"	0 0 0
Yellow Metal Sheathing	per lb.	0 0 9½	"	0 0 0
STEEL:				
Swedish Keg	pr. ton	15 0 0	"	0 0 0
" Faggot	"	16 0 0	"	0 0 0
TIN:				
English, Block	p. cwt.	4 1 0	"	0 0 0
" Bar	"	0 2 0	"	0 0 0
Foreign, Banca	"	0 4 0	"	0 0 0
" Straits	"	0 7 0	"	0 0 0
TINPLATES:				
Charcoal, I.C.	pr. box	1 4 6	"	1 7 0
Coke, I.C.	"	1 2 6	"	0 0 0
LEAD:				
Pig, English	pr. ton	19 15 0	"	21 0 0
" Spanish	"	19 0 0	"	19 10 0
Common Sheet	"	21 10 0		22 0 0
Tea " (Wimshurst's Patent) A special disct.	"	35 0 0	"	0 0 0
SPELTER:				
On the spot	"	18 10 0	"	0 0 0
For arrival	"	18 5 0	"	18 7 6
ZINC:				
English Sheet	"	24 0 0	"	0 0 0
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0

JAMES LAURIE, Metal Broker.
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 25, 1862.

ECONOMIC MUSEUMS.

A short time since, in an article on "Remarkable Exhibitions," we called attention to the Economic Museum which Mr. T. Twining, of Twickenham, had called into existence.

That gentleman, in 1857, addressed a communication to the Chairman of the Council of the Society of Arts, in which the following passages occur:—"The experience acquired since 1847, as a member of the Managing Committee of the Labourers' Friend Society, has led me to a conviction that much of the privation, discomfort, and ill-health to which the working-classes are subject in this and other countries, and many of the errors and failures of the friends of the poor in their benevolent endeavours, might be avoided by a more general diffusion of that kind of practical knowledge, in matters of domestic and sanitary economy, which may be termed the science of common life. I perceived, at the same time, that the only way to make that knowledge popular was to offer it in an easy, familiar, and attractive form; and thus I was naturally led to the plan of establishing exhibitions and permanent museums of domestic economy."

Mr. Twining had, in fact, been quietly working out this theory since the year 1850. In 1855 it was fully developed in a memorandum addressed by him to Lord Ebrington. Copies of this memorandum were printed, and extensively distributed throughout Great Britain and the Colonies. It was an able document upon the subject of which it treated, and we may judge its general character from the following extract:—"Manufacturers, tradesmen, and mechanics, work their inventive abilities (as a rule) in a business-like manner. Men of science, more especially so-called, have not yet, generally speaking, attained to such a standing in this country as to be able to lay aside the thoughts of themselves and their families. Even amateurs, though their position may raise them above pecuniary considerations, are seldom above the temptation of bringing out that which may be conspicuous, in preference to that which may be useful. In short, the homage of knowledge and ingenuity is very naturally paid to those who can best give an acceptable return; and whilst every appliance of Science and Art is called into requisition to meet the fastidious fancies of the rich, and to supply novelties for the cravings of fashion, the requirements of the humbler classes are comparatively overlooked."

The writer evidently saw one of the great causes of the destitution and criminality which disfigure the annals of our own, and other countries, and he determined also to point out the remedy, and, if possible, employ it. The publication of the memorandum and the persevering industry of its framer were soon responded to and rewarded. Economic Exhibitions of a temporary kind were inaugurated at Paris in 1855, at Brussels in 1856, and at Vienna in 1857. These were all successful in a very high degree. At the South Kensington Museum, too, Mr. Twining succeeded in getting a section appropriated to the purpose he had in view. This was called "The Department of Domestic Economy, comprising Illustrations of Every-day Life for the Working-classes;" and of its nature and usefulness it is unnecessary for us here to speak.

Encouraged by the success of the embryo collection at South Kensington, which had been formed there permissively and experimentally, Mr. Twining removed the exhibition to the Polytechnic Institution, and has now finally removed it to Perryn House, near the railway station, Twickenham, for convenience and more complete development. It is, in fact, as the example for a grand Metropolitan Economic Museum, and for branch museums throughout the country, that the founder of the present institution at Twickenham desires that institution to be regarded. He is, indeed, of opinion that Economic collections should be established on all hands, whose object would be to impart to all classes, and especially to those whose income is small, the "knowledge of common things, or science of every-day life." He would have them show, for instance, what sort of dwellings they should live in to secure health and comfort, and what improvements in household management may be derived from the discoveries of science, or from other sources. In short, he would have the Economic Museum teach the working-classes how to live with judgment, and get the best money's worth for their money.

It would be difficult to conceive more praiseworthy objects than those sketched out by Mr. Twining, and it is satisfactory to know that they are not the visions of a philanthropic dreamer, but the aims of a sterling, steadfast, and determined man.

In the establishment of the Economic Museum at Perryn House, we see an earnest of future and permanent good to the working classes of this country. It is an exemplification of what the will and energy of one man may accomplish, when the will and energy are governed by right principles and guided to practical ends. We do not despair, indeed, of seeing "London with its Economic Museum on the fullest scale, provincial towns with appointed collectors, Mechanics' Institutions, with rooms allotted to the illustrations of common life, Lecturers supplied with portable Economic Collections and Educational Establishments, down to Village Schools with their Economiums or Cabinets of Useful Objects." When this state of things shall have arisen—and it is no utopia that we are picturing—how much of misery, how much of degradation, and how much of *crime*, will be in a fair way of being banished for ever from among us? The barriers between classes which selfishness has created, and which ignorance maintains, will be thrown down, and that sympathy, of which the good Judge Talford spoke, and which, with his dying breath he invoked, will disseminate its divine influence on all around. The great merits of Mr. Twining's scheme of popular education, are its practicability and freedom from any shade of sectarianism. Its advantages will not and cannot be confined to any one class, sect, denomination, or sex, but to the humbler portion of the community, irrespective of all distinctions, the good resulting from its realization must be considerable.

Amid the din and clatter made about iron ships, rifled guns, submerged vessels, projectiles, targets, and fortifications, it is pleasant to turn aside for an instant and look approvingly upon the efforts which are being made for the amelioration of the troubles, difficulties, and cares which beset those whose "lot it is to labour."

The Perryn House Economic Model Museum is divided into nine classes, as follows:—

Class I.—Building Designs.
Class II.—Building Materials.
Class III.—Furniture.
Class IV.—Clothing.
Class V.—Food, Fuel, and other Household Stores.
Class VI.—Health.
Class VII.—Home Education, Self-Instruction, Recreation.
Class VIII.—Miscellaneous.
Class IX.—The Library.

The Museum is open to the public only on Wednesdays and Saturdays, from 2 to 5 p.m., on the presentation of tickets of admission, which may be obtained from Mr. Twining, or at the Society of Arts, Adelphi, London. The founder of the Museum is entitled to expect co-operation, and we cordially invoke its aid in so good a cause. The Library as it exists at present is admirable, but its extension by donations of eligible books is a thing to be desired.

NAVAL ARMOUR COMMISSION.

We call attention to the letter of our correspondent, "A Civilian," in this day's impression. His letter to the *Times* is outspoken, and discloses a series of contradictory reports and opinions on the naval defence question. We confess, however, our surprise, that on a question of so momentous a character, the *Times* has not, on this occasion, displayed that candour in acknowledging itself to have been in the wrong, and that frankness in changing its policy when great national interests are at stake, which we have often admired, and which are its best titles to its vast popularity and circulation, as an exponent of public opinion. We make these remarks on a contemporary with the more freedom, because the strictures of our correspondent do not impugn its good faith, but are addressed to a "graphic" reporter who, amidst the din of artillery, had to record events of an exciting and novel character, and could not avoid receiving the impressions of the day. There is, however, another point of view which induces us to regard this matter in a serious light. Whether the *Times* is influenced by its reporter, or is blind to the truth, we cannot tell; but, unfortunately, its reports, under the head of "Military and Naval Intelligence," are regarded by the public as *quasi* official. Not only in England, but also in foreign countries, they are read with the same interest as the semi-official or "communiqué" articles of the *Moniteur* and other French journals. Nor does this impression on the public mind appear to be unfounded, for the minuteness and regularity with which military and naval news are published daily in the *Times* go far to prove they are supplied from official sources, and it will be in the recollection of our readers that a few days ago the Secretary to the Admiralty, in his place in the House of Commons, referred to the report in the *Times* as a faithful account of the experiments at Shoeburyness with the new Armstrong gun.

Why do we thus pertinaciously dwell on this subject? The answer is ready. Because it is one of such intense national importance that it has not had its equal in our time. In one day, as it were, England is stripped of her naval power. For defence or offence she is reduced to the level of the smallest maritime state, and two powerful nations, France and the United States, in the new race of naval supremacy, have got the start, and are using prodigious efforts to outstrip us. This is no light matter. The French journals inform us, that in a short time a squadron of evolution of six iron-plated men of war will be at sea, whilst there is not a shadow of a doubt as to the fact, that with iron-cased ships, gun-boats, floating batteries, and disembarkation flat-bottoms, already in commission, launched or in course of construction, France is in an advanced state of preparation for naval hostilities on a grand scale. In the United States, we know of five or six ironsides in commission, and from official accounts, federal and confederate, not less than fifteen or twenty vessels of that description will, in a few months, be ready to take a part in any naval conflict which may arise. Russia, Denmark, Spain, and Italy, have all ordered iron-plated ships, some of which are in a forward state.

What is England, we ask, doing to oppose this prodigious development of maritime energy in other countries? Her traditional protection has vanished "like the baseless "fabric of a vision." Her wooden walls are no more, and the iron walls have yet to be built. Are the English people in the presence of this mighty fact to be pacified by the *nonchalant* assertions of newspaper reporters, that our Warriors and Defences are the most powerful iron-clad ships in the world, and that we possess the only *one* gun which can penetrate iron plates, or are they to be tranquillised by the assurance of a noble duke in one house and a bland secretary in the other, that in two or three years we shall have a fleet of six different classes of ironsides afloat, which will defy the world in arms? Long before that time—aye, before the expiration of the year—every roadstead port and naval arsenal of Great Britain and her colonies might be attacked by iron-clad ships, invulnerable to our present means of defence. The result of such a calamitous event would be indescribable destruction of our naval resources, without the power of resistance on our part, unless Government promptly and energetically change their mode of proceeding.

The writer who, under the signature of "Pioneer," is the advocate in the *Times* of the discomfited or expectant Portsmouth contractors, is renewing his fallacious arguments in support of the erection of the Spithead Forts. The exploits of the 156-pounder Armstrong have given him new life, and encouraged him to make another attempt to save the forts from abandonment.

He contends, because it was at first maintained that the supposed invulnerability of iron clad ships rendered forts useless, inasmuch as their guns could produce no effect on ironsides, that now that a gun has started into light which has penetrated the Warrior armour plates at 200 yards range, the argument against forts is destroyed. But "Pioneer" is a poor logician. The *absolute* invulnerability of iron-cased vessels is not the question, nobody supposed that armour plates could not, under any circumstances, be penetrated by projectiles, no matter what might be their weight, or the force of the charge with which they were propelled.

The astounding manner in which the Merrimac withstood the fire of powerful batteries of forts and men of war is mentioned in the statements quoted by "Pioneer" as evidence of the immensely increased power of resistance of an iron-clad ship as compared with a wooden ship, and especially to demonstrate that iron plates could not be penetrated with those terrible explosive missiles which hurl instant destruction on the strongest wooden men of war.

The force of the 156 lb. shunt, or a far more powerful gun, does not weaken the chief argument against forts as compared with floating batteries. The former are immovable, the latter are movable. The range at which the guns of a fort can attack an enemy afloat is not determined by its own choice, but by that of the hostile ship, which may take up its own distance, and place itself within range to shell a fort or a dockyard, without being exposed to any damage from the fire of a fort at long range.

Projectiles lose their force rapidly as the range increases. A shot from the heaviest ordnance that can be constructed which was irresistible at 200 or 500 yards, might be incapable of making any impression on iron armour at 1,000 yards. The iron-clad ship, by keeping out of the damaging range of the guns of the fort, might with impunity, although under its fire, bombard a harbour or a town, if it were not attacked at sea by an armour-plated vessel of equal force, and equally well protected.

In which ever way this question is examined, we are brought to the conclusion that the immediate want of the country in its naval department is floating batteries. In a few days, when Parliament re-assembles, the means of supplying this want will take a prominent place in the debates. There can be little doubt that the obvious mode of effecting the desired object will be found to be the conversion of wooden men of war which are now useless into iron-cased structures, and the most urgent business of the session will be to determine the best and readiest mode of conversion. For that purpose it is requisite to find out the most efficient system of armour plating, and this from the entire novelty of the art can be ascertained only by a series of experiments conducted with intelligence and discrimination. In order to arrive at a satisfactory result in that respect, and to tranquillize the nation, there is but one safe course to pursue, and that is the immediate formation of a competent and independent *Naval Armour Commission.*

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER IX.

Thinking it conducive to the public interest to enable the *Times* to correct the mistaken conclusions it has drawn from experiments on armour-plates, I addressed a letter to that journal. As it has not been inserted in the *Times*, I send you a copy of the letter, which you, perhaps, will think it desirable to publish, as it affords useful data to compare the two sides of the question—the attack and defence—by referring to practical results. Whilst animadverting on the inconsistencies of the *Times'* reporter, it must be admitted there is so much doubt and uncertainty on this subject, it is hardly possible to have fixed ideas upon it. The laws of projectile forces, and the means of opposing them, are imperfectly understood; recent experiments have disclosed new and apparently contradictory facts, so that much remains to be learned, and nobody is safe in laying down the principles of the best modes of constructing guns, projectiles, or defensive armour. Considering the imminent importance of this absorbing question, I have been at great pains in investigating the reports of experiments, and carefully examining the results. Not wishing to be influenced by or suspected of partiality or prejudice in favour of or against any system, I have given extracts of published reports thought to be official, and they shew a series of palpable contradictions.

In June last, the 100-pounder Armstrong gun was triumphant; in October it was defeated and surpassed by the 68-pounder; in April a new Armstrong is in the ascendant. When again tried on armour better constructed than that of the Warrior, the 156-pounder may turn out to be as great a delusion as the 100-pounder has proved to be. Ought not all these discrepancies and contradictions make us hesitate, and pause to ascertain whether we are not throwing away millions on an erroneous application of a new system of naval defence. It would be a fearful thing to be involved in war, and find that our iron-clad navy was inefficiently protected, and could be destroyed by an enemy's more invulnerable ships.

In a conflict between an iron-clad frigate of the Warrior class and the Gloire, there is reason to fear the former, with her defective armour, her extremities unprotected, and her present armament, would be destroyed, or forced to strike her colours within an hour. The Gloire's armour, like that of the Warrior, consists of plates laid on wooden planks. In that respect the two ships are on an equality; but the plates are more securely fastened on the Gloire, and are therefore less liable to be detached from the side of the ship. This is a source of danger which has before been pointed out, and which, so far from being imaginary or unimportant, is of the most alarming character; for, as the loss of a single plate would make a great gap of forty or fifty square feet in her armour, the ship would practically cease to be invulnerable. Even the little Monitor, with half-a-dozen discharges of her two powerful guns, might detach a plate from the Warrior, which then would be at her mercy. The character of the large calibre guns used by the Americans is calculated to destroy the fastenings of plates on the Warrior plan. This has been proved by the results of experiments at Shoeburyness. The 200-pounder Armstrong bolts, fired with small charges, of which the effect is pronounced by the *Times*, on the authority of Sir William, to be analagous to that of the large calibre Dahlgren, and other monster projectiles, and even ten-inch shell, loaded with sand, which have no penetrating power, were found to be most effective in fracturing fastenings which consist of through bolts, or any other contrivance whereby the fastening has to sustain the impact or jar of the blow. In the case of the Jones target at Portsmouth, and the two Fairbairn and Warrior targets at Shoeburyness, the really serious damage was inflicted, not by the penetrating force of the projectiles, but by the concussion on the structure as a whole, or by the crushing effect of the force driving the plates into the soft wood, and thereby buckling the edges and destroying the fastenings. If I keep repeating these explanations. it is to impress on the public mind, and on the guardians of our nation's existence, that the security of the fastenings of armour-plates is a question of more importance at this moment than the penetrating force of projectiles. In other words, the actual emergency is greater for invulnerable structures than for the most powerful weapon of destruction.

It must, I think, be admitted, that the facts and statements detailed in my letter to the *Times* prove that I was justified in making the observations I addressed to that journal.

Returning to the practical object of my letters, and not to encroach too much on your space, out of the number of plans which have been submitted to the Mechanics' Magazine, I will briefly notice those which contain some novelty.

The plan of Mr. J. A. Slater, of Bolton, possesses so much merit, that I send you his own description and diagram for insertion.* It is an ingenious idea, and might be applied with success if available in practice, on which I will not venture to give a decided opinion. There certainly would be difficulties of manufacture and construction. The welding of the holding bars *b c d e* to the back of the armour plates, on which the security of the system depends, if not perfectly sound work, could not be relied upon to stand the shock of artillery. The proposed mode of keying, and indeed the plan itself, is similar in principle to an invention already patented, and which, I believe, is under the consideration of the Admiralty, but still there is enough of difference in the mode of construction to constitute Mr. Slater's plan a different invention. Considering it to be well worthy of attention, I recommend him to submit it to the Admiralty; at the same time, adhering to one of the principles I have before enunciated, I am of opinion that the fastening being part and parcel of the plate itself, so that it must feel the vibration of the iron, it will, like the screw bolt tapped into the plate, be broken by the shock of impact. I also think the keying-up mode of fastening is more liable to fracture than the screw nut, because the bolt on each side of the slot must be reduced to at least one-third the thickness of the iron.

---

* The letter will appear in our next Number.

Mr. J. Scott, of Sussex-gardens, Hyde-park, gives a minute description and drawings of a plan, whereby "in place of bolts separate from "the plates, the fastenings should be portions "of the plates—Thus, the plates shall be formed "with tongues at suitable distances on the "upper and lower edges, but at right angles to "the plates—that these tongues being passed "through the frame of the ship, shall be "secured by keys or wedges driven into slots "formed at their extremities."

It will be seen that this plan is identical in principle with Mr. Slater's, whose communication has precedence in order of date. Mr. Scott is entitled to credit for originating the same idea, for which reason I mention his plan, but it is unnecessary to repeat observations already made. He and Mr. Slater may find it to their advantage to unite in urging their claim for a trial on Government. Their combined ingenuity may overcome the difficulties of execution I have alluded to.

Mr. R. J. Balston, of Thornhill, Maidstone, conceives that the arch principle, in the shape of tubular iron plates supporting armour plates, with a succession of curves on the under side, will afford strength and lightness combined. He sends the diagrams of a section, ingeniously devised, which I will not put you to the expense of engraving, because the conception is a mistake. It has the aspect of a bridge, of which the spaces representing arches are proposed to be filled with teak. It is useless to repeat what has been so often said about the absolute inefficiency of wood-backing. But Mr. Balston has fallen into an error which is very prevalent. He confounds the *penetrating* with the *crushing* effect of projectiles, on which much remains to be said. The arch principle gives strength to a structure as a whole, and may be applied with advantage to support the sides of a ship inside *the skin*; but immediately behind the plates, to oppose the penetrating effect of shot it is of no use whatever. The proposed iron arches, 2½ inches thick at the crown and backed with wood, would be pierced through and through with a 40-pounder shot. The Iron Plate Committee's target experiments have settled that point.

Mr. W. H. Eveleigh, engineer, of Woolwich, has a plan for arranging slabs of iron 5 inches thick, with angle ribs at the back, of the same thickness, and the interstices between the ribs filled with teak. Here again is the fatal objection of wood-backing. The 5-inch iron plate is the maximum force of resistance, through which the soft wood-backing and the spaces between the ribs would facilitate the passage of a projectile, like the die under a plate in a punching machine.

Mr. Arthur Gearing, of Fairview, Cheltenham, sends the original letter, dated 14th Jan., 1861, which he addressed to the Secretary of State for War, which relates to "a very powerful cannon, capable of discharging projectiles "of greater weight and size, with increased "velocity at the moment of striking an iron-"plated ship, than any other cannon in use." As this does not come within my province, I shall be excused for not commenting upon it. But I cannot refrain from mentioning that Mr. Gearing, having written to Sir William Armstrong, was referred to the "War Office," in which limbo of inventions his proposal has lain untried and unheeded more than twelve months.

The plans and suggestions of Mr. Gearing (a second letter), Mr. Hetherington, and a Northampton Subscriber, were received too late for notice in this number of the Magazine.

A Civilian.

THE MANUFACTURE OF LEATHER CLOTH.

The manufacture of leather cloth as a substitute for Morocco leather, was commenced in the year 1849 in the city of Newark, U.S. The first specimen of it seen in this country, was exhibited in 1851. The Americans have had the merit of producing many labour saving machines and articles of domestic convenience, and many of them are becoming increasingly known and extensively adopted in this country. It is certain that this article of leather cloth has superseded the use of leather for many purposes to which the old material has hitherto been applied, besides being put to uses for which leather is wholly unsuitable. Messrs. Crockett, the inventors and patentees, commenced the manufacture of leather cloth in England in 1855, and their factory was an old workhouse, situate in one of those dreary, unpicturesque marshes at West Ham, in Essex, a locality somewhat famous for its insalubrious manufactures. The firm was known as the "Crockett International Leather Cloth Company." In 1857 Messrs. Crockett surrendered their business to a company formed under the title of "The Leather Cloth Company Limited," which purchased the entire European business.

The new company, with a paid up capital of £90,000, and having Mr. A. Lorsont as their managing director, began the enterprise with great energy, They erected substantial and extensive premises. which cover ten acres of ground, employing upwards of 200 men. They produce daily 1,000 pieces of 12 yards long and 1¼ yards wide, or 15,000 square yards; sufficient if laid end to end to reach from their factory to the warehouse in Cannon Street West—a distance of seven miles.

It will be evident that an article intended to resemble leather should be pliant, supple, and not liable to peel off or to crack. These excellencies are to be attained by the peculiar ingredients of the composition with which the cloth is covered, and the method of applying it. On entering the factory, our attention was first directed to the boiling room, in which there are 12 furnaces, with a large cauldron over each for boiling linseed oil. This process is attended with considerable danger from the liability of the boiling oil to generate gas and explode; hence, a man is stationed at each cauldron stirring gently the boiling mass and watching a thermometer inserted in it, and which at the time of our visit stood at 580°. The oil is supplied to the boiling-house by pipes from an adjoining building, where there is a huge tank with nine compartments containing 3,200 gallons each, or 28,800 altogether, amounting to 122 tons of oil. The boiled oil being allowed to cool is conveyed on a tramway to the mixing-house, where, in a puddling machine, it receives several other ingredients, the principal ones being lampblack and turpentine, which being mixed into a composition is ready for use.

The cloth to which this composition is applied is known by the name of "greys," or unbleached cotton. It is of a peculiar manufacture, and made expressly for the company. The store room is a spacious building, and will contain an immense stock; at present it has 25,000 pieces, or 300,000 yards. Here the cloth is calendered, and cut into lengths of twelve yards. The two ends of each length are sewn together to make it endless; two sewing machines are in constant operation at this work. The pieces are then removed to the "milling" rooms, so called because they contain the mills on which the cloth receives the composition. These mills are rough-looking wooden structures, having a drum at one end and a roller at the other, over which the cloth is passed, and then tightened by a crank and wheel at one end. A large frame-knife, or scraper, is then dropped down close to the cloth, a measured quantity of composition being laid on the cloth along the edge of the knife, the mill revolves, and the cloth receives as much of the composition as can pass under the edge of the knife. The piece is then carried to the heating room adjoining, and hung up on the rack to dry till next morning.

There are on the premises six milling-rooms, with three mills in each, and having three men attendant upon each mill. The adjoining rooms for drying are heated by three rows of pipes laid along the wall. These pipes, during the day, are at a temperature of about 130°. The temperature is increased towards the evening, and during the night to 160°, and it is the duty of the watchman to open the doors for ventilation and cooling preparatory to the men resuming their work for the next coating.

Of course, in a building so greatly heated, and having so much inflammable material within it, the danger of fire is imminent, but every precaution has been taken which prudence could dictate. The building is fire proof, the floors are of metallic lava, and the roof, which is flat, is of the same material. A large pipe runs up the outside wall by the partition which divides the drying-rooms, into each of which runs a branch pipe with a valve, which can be worked from the outside. A deluge of steam can by these means be poured into the rooms in a few minutes by day or night. There are fourteen fire plugs around the buildings, on the main of the East London Water Works, with hose and turncock at hand, so that ample means of extinguishing fire exist on the premises.

But to return to the manufacture. The coating being thoroughly dry, the cloth is then taken to the "rubbers," whose business it is to remove all inequalities from the surface and make it perfectly smooth. This is done by the "rubbing machine," (an ingenious contrivance of Mr. Eagles, the manager,) by which the cloth is made to pass under two rollers revolving in opposite directions. These rollers are covered with pumice stone, and do the work completely and expeditiously, which, till lately, was done by hand at great expense of labour. The "coating" and the "rubbing" being repeated four, and in the case of heavy goods, five times, the cloth is ready for the "painters." The "painting rooms" contain machines similar to the "mills;" but instead of the drum they have a roller at each end, over which the cloth passes slowly, and a man at each side applies the paint, "meeting each other half way." Dependant partly on the colours, and partly on the article to be produced, is the number of coats of paint to be applied. Sometimes two will be sufficient, at other times four are necessary. The last coat receives several applications of a peculiar elastic enamel, composed chiefly of copal varnish, to protect it from the action of the atmosphere.

At this stage of the process the edges of the cloth are rough and have to be trimmed, and the seam by which the ends are sewn together has to be cut. This is done by a machine called the "Guillotine," and we now follow the cloth to the "grainer." This latter, and, to the ordinary leather cloth, finishing process, is done by a remarkably beautiful iron machine, having two rollers, the upper one being of polished iron cut obliquely on the surface, the under one of paper. Between these two rollers the cloth passes twice and receives its external resemblance to morocco leather. There are six machines used for this finishing process, and others for embossing from the small diamond to the large mediæval pattern. The latter consumes much more time in passing through the machines. The cloth is now stamped with the trade mark, labelled, and rolled up ready for transmission to the warehouse in Cannon Street West.

On looking at the pieces when finished, one is struck by the extreme cleanness of the inner side after passing through so many soiling operations; this is owing to the practical skill with which the men handle the cloth, and to the agility with which they remove it from the several machines, and carry it to the drying rooms. While watching the process, we thought that in many respects, it was similar to the tanning with sumach, from the leaves and stalks of the *Rhus coriaria*, by means of which skins are made into morocco leather. As the leather cloth can be made permanently soft and elastic by the oily matter combining with the texture of the cloth, as it does with the fibres of the skin, the imitation is complete and successful.

There is another room in this establishment, specially interesting to the artist, where the cloth is printed in gold and colours, in designs which are really chaste and beautiful, and which, when used for the furniture and hangings, adorn rooms with something of oriental splendour. Here, too, there are table-covers with floral borders, rich in colour and choice in grouping, with centre pieces, which, as specimens of decorative art, are very effective. Many of these will be displayed at the International Exhibition, and, we doubt not, will excite both surprise and admiration.

The mixing-room is a kind of *sanctum* of the manager's, and we suppose that from the skill with which the colours are prepared arises much of the excellence of the company's manufacture. In a room adjoining there are sixteen colour-grinding mills, constructed on the American principle, and worked by machinery, as indeed almost everything on the premises seems to be. The machine which sets all in motion is a high-pressure double cylinder engine of 50-horse power made by Woods, of Halifax. There are three immense Cornish boilers by Hill, of Heywood, which have been tested to a water pressure of 130lbs. to the square inch and represent 60-horse power. One of these is sufficient to work the engine by day and heat the drying rooms by night. We observed that, by the generosity of the company, a part of their premises had been given for the use of the Fifth Essex Rifle Volunteers, the drill room and armoury are magnificent apartments, such as are seldom seen devoted to such a purpose.

A writer in a very useful work on the "Manufactures of Great Britain," asks somewhat triumphantly, "What substitute could be found for leather? a substance at once durable and elastic, affording protection from wet and from cold, capable of being formed into innumerable useful articles, and susceptible of a high degree of ornament, and supplying lining to our carriages and, covers to our books." This book was published in 1848, under the direction of the "Committee of general literature and education," and now in 1862, we have a substitute answering all the requirements here specified.

As to protection from wet and cold, the whole American army is equipped with leather cloth in the shape of capes, leggings, and knapsacks, our upholsterers can vouch for its durability and elasticity. The useful articles into which it can be made, and the degree of ornamentation it can receive, are becoming every day more manifest. We line our railway, our street carriages, and our hats with it; and as to our books, if they are not covered with it they ought to be. Truly our progress in art and science is defying all prediction as to what we may not accomplish, and rendering obsolete many of our familiar proverbs, and none more strikingly so than that "there is nothing like leather."

A VISIT TO THE WOLVERTON WORKS.

By CHARLES B. KING, M.E.

THE locomotive, from the time of its first invention to the present moment, has progressed in its development. It has been the subject of improvements from men of genius and skill, to whom society owes considerable gratitude. Need we mention the names of Watt, Murdock, Trevithick, Blenkinsop, Stephenson, Braithwaite, and a host of others.

The great outlay attending the continual wear and tear of rolling stock, induced nearly all the railway companies to erect workshops at convenient portions of their line, for the purpose of effecting repairs. The success of such undertaking has been proved so far, that works established for the purpose specified, now build *new* engines as well as repair old ones.

The following description of one of the largest places of this kind, will, we trust, prove acceptable to the majority of our readers. Wolverton is situated 52½ miles from London, on the London and North Western Railway, and was first established in 1836 by the Company, as a depot and repairing shop, when the works covered about four acres of ground. It gave employment to 100 men, the population of the place scarcely exceeding 200. Mr. Edward Berry (who had previously been a locomotive engine builder) was appointed superintendent, but resigned his post in 1847, and he commenced locomotive building at Liverpool. He was succeeded by the late talented superintendent Mr. J. E. McConnell, under whose management the works attained their present gigantic proportions, constructing one new engine weekly, and repairing, on an average, nine old ones. There are now 2,200 men on the books, receiving weekly wages amounting to £2,100. With the works the town has also increased. It now possesses a church of considerable pretentions, with schools and a Mechanics' Institute. The company some years back, on account of their increasing business, built a large number of cottages, about a mile from Wolverton, for the residence of their men. It has a church, schools, and some dissenting chapels, and is called Stantonbury. The joint population of the two places is between five and six thousand.

Owing to their gradual rise, the works consist of a collection of shops of different and varied construction, some being large and commodious, others inconvenient and cramped. They are erected on both sides of the line, and cover about thirteen acres of ground.

Smiths' Shops.—Of these there are two, one on the east, the other on the west side of the line. That on the west side is an entirely new building and is the finest of its kind we have seen, being 326 feet long by 90 feet wide. It is furnished with one hundred forges ranged the whole length on both sides, while in the middle are erected six of Nasmyth's fifteen hundred weight steam hammers.

The *Boiler Shop* runs parallel to the smiths' shop, and is also a new building, with a glass roof. On the day of our visit there were seventeen new boilers and six tenders on hand. A noticeable feature in the former was the introduction of a welt instead of a lap joint for the boiler barrels, giving thereby considerable additional strength. The shop contains twenty-one forges, one steam hammer, two plate-bending rolls with reversing gear, ten drilling machines, a small lathe for cutting dies, a circular saw running at a thousand revolutions per minute for cutting hot angle iron, by which means a great saving is effected both in time and material, three-inch angle iron can be cut by it in a second.

In one corner is one of Haley's steam rivet-making machines, by which one man and two boys are able to turn out seventeen rivets per minute. One of Garforth's steam riveters is also at work, capable of riveting the barrel of a locomotive engine throughout in a day of ten hours, driving about 820 rivets. There are a number of punching and shearing machines, some of great power; one on the lever principle deserves notice as being of Wolverton manufacture. Its framing, which is cast in one piece, is nine tons.

Cast-iron columns with wrought-iron girders support the roof of this building, and form bearings for two large travelling cranes of great power. Some plates were shown us in this shop, one 14 feet 4 inches × 4 feet 4 inches × ½ inch, another 8 feet 6 inches × 6 feet 9 inches × ¾ inch, also a copper plate 6 feet 8 inches × 7 feet 2 inches × ½ inch.

Running parallel to this is an erecting shop, the same size and similar in all respects to the boiler shop. One fine locomotive, intended for the forthcoming Exhibition, has just been made here. Its cylinders are 18 inches diameter by 24 inches stroke, with a 7½ feet driving wheel. It is intended to work at 150 lbs. pressure. Its workmanship is first-class, and will ably sustain the reputation of the works. Thirty-six engines have been turned out of this shop since its erection last year. Twelve are now in preparation. Two travelling cranes, capable of lifting 40 tons, perform the heavy lifting.

The pattern-making and carpenters' shops are also on the west side, furnished with lathes and other machines, and are capacious, and admirably adapted to their work.

The fitting and turning shops are very numerous. In one there are 89 men at work, with 31 lathes, &c. One slotting machine has the novel application of elliptical cog wheels, securing a quick return of the tool.

In the next shop, among various other machinery, we noticed a powerful horizontal shearing machine for cutting old tyres, and in one large lathe two cast-steel wheels with corrugated webs are being turned.

In the wheel-turning shops there is one of Whitworth's large slotting machines, worked by screw instead of the crank.

The wheelyard contains two hydraulic presses for putting wheels on axles, and a shearing machine. The foundry is capable of very extensive operations, being fitted with a large cupola furnace and other plant. A casting, weighing 9 tons, has been executed. About 11½ tons weekly is the average amount of work. From the brass foundry, where there are 8 furnaces, about 3½ tons of metal are turned out weekly. Among the wonders of the other shops we can only notice a monster steam hammer of 50 cwt., and a large slotting machine 29 feet long.

To describe the stores minutely is impossible, we can consequently only take a cursory glance. There are stacks of brass tubes, all kinds of engine duplicates, bolts and nuts, boiler plates, bar iron, forgings of all descriptions, and, in fact, everything requisite for a large establishment. Noticeable were a number of Giffard's feed-water injectors, which will, doubtless, rapidly supersede feed-pumps. They are applied to the major part of the London and North Western Railway engines, where their working has given great satisfaction.

There is a large fitting and turning shop on the east side, and near it the repairing shop. This is a large building, capable of accommodating thirty-two engines. A travelling table, driven by a small locomotive, runs the whole length of the shop, by which engines are shunted. They are drawn on the table by chains reefed round three pulley blocks, and then moved by the engine. Grease from axle-boxes is removed by steam, not burnt off, as in some shops. A great saving is effected by this, for by burning the metal from the bearings is often burnt out and destroyed.

In the tender shop are several tenders in various stages of progression. And among other shops are some new ones capable of storing thirty-six engines and tenders. Here they are painted and finished. We subjoin a list of the machines in constant uses for locomotive purposes, requiring eleven stationary engines to drive them :—

Lathes	145
Planing machines	20
Slotting and shaping	57
Drilling machines	73
Screwing machines	10
Cylinder boring machines	2
Portable boring machines	2
Riveting machine	1
Rivet-making machine	1
Shearing machines	15
Bolt-forging machines	3
Circular saws for irons	4
Hydraulic presses	2
Steam hammers	10
Rolling mill	1
Tyre rolling machine	1
Plate-bending machine	2
	349

A MOVING TARGET.

A correspondent, for whom we entertain a high respect, and whose knowledge of shipping and of gunnery is of a practical, rather than a theoretical character, is of opinion that the recent trials of the Armstrong gun at Shoeburyness were improperly conducted, and that the results arising therefrom are valueless and delusive. He is anxious to see a real trial, as he terms it, made of the 300-pounder, of which so much has been favourably said by the *Times*, and some other journals. In order to effect this he would have the gun placed in some eligible fort on the sea coast—say the Lumps Fort, near Portsmouth, for example—and then a ship, whose sides and interior were fitted in the manner in which an enemy's ship would be most likely constructed, should be towed slowly past the fort and serve for a target. When our correspondent speaks of a ship thus built, he explains that it "should have the benefit of beams and riders, straps and knees, shelf-pieces, and diagonal iron plates on the inside; seasoned oak frames, and African oak planks covered with five or six inch iron plates, diagonally or vertically fixed on the outside." Such a vessel moving at a moderate speed in front of the gun of Sir William Armstrong, would, he maintains, constitute a proper object for testing its destructive powers. If this trial were to take place, our correspondent is willing to *remain on board the ship* during its progress, and to enter into the following arrangement with Sir William: Let Sir William promise to pay £100 for every shot fired at, and which shall *not* pass through, the ship's side, and our correspondent will guarantee to pay Sir William £1,000 for every shot so fired, and which shall pass through it.

We are in a condition to say that this is no idle challenge, but a *bona fidé* one, and one which the gentleman offering it is able and willing to stand by. The fact is, as he asserts, that "a target built on shore cannot be so strong as the ship herself, while all the other conditions involved are different." The targets lately used at Shoeburyness were especially defective, they were of the wrong shape, in the wrong position, composed of the wrong materials, and not strengthened sufficiently. Besides this, they were stationary, and that is a radical error. Certainly those trials have not decided the question of the artillerist *versus* the shipbuilder; and we commend to the notice of Sir William Armstrong and the Admiralty, the suggestion of our correspondent, which is far more likely to lead to decisive results than the sham trials at Shoeburyness.

TRIAL OF STEAM FIRE ENGINES.

On Wednesday, the 16th, a trial of the steam fire-engines belonging to the London Fire Engine Establishment, was made at the distillery of Mr. Frederick Hodges, Church-street, Lambeth, in the presence of a numerous company, among whom we observed Mr. Newmarsh, Mr. Baddeley, the Duke of Sutherland, the Earl and Countess of Caithness, Captain Fowke, R.E., Captain Shaw, L. F.E., Mr. Charles B. King, M.E., Captain Bent, of the International Exhibition, Mr. Wellington Lee, of New York, Mr. H. S. Beddons, of Lloyds, Mr. Browne, of the Westminster Fire Office, Mr. Charles White, of the County Fire Office, Mr. Passmore Edwards, Mr. Colburn, C.E., Mr. Shand, Signor Casentini, and many others.

The new steam fire-engine recently made for the London Fire Engine Establishment is of nearly the same dimensions as the one which has so long been located at Watling-street, but which has now been removed to Chandos-street station, to give place to the new one.

Steam was got up in 15 minutes from the time the fuel was lighted, with a 100lb. pressure of water and 120 lbs. pressure of steam. Though a brisk wind was blowing, a jet of water from an inch and quarter nozzle was thrown perpendicularly 160 feet high, and upwards of 200 feet horizontally. A tank of water holding 459 gallons was emptied in one minute and a quarter, thus doing as much work as four hand-worked brigade engines at their ordinary rate of working.

Mr. Hodges then manned one of his handsome hand engines (which weighs, when fully mounted with complement of men, &c., about two tons), and threw a 1¼-inch stream a horizontal distance of 190 feet.

The large hand engine made by Messrs. Merryweather and Son for the London and North Western Railway Company was next "trotted out." It requiring fifty men to work it. The Duke of Sutherland, the Earl of Caithness, and all the other visitors did themselves the honour of seizing the handles and pumping most lustily. The playing, however, of this engine fell short of Mr. Hodges'. It is fitted with quick pumps, with a 9¼-inch stroke.

The visitors were shown the handsome design for the decorations of the new fire engine making by Messrs. Merryweather and Son, of Long Acre, and about to be presented to Mr. Hodges by the residents of Lambeth. The designs of the engine are by Signor Casentini, of Hercules-buildings, Westminster-road, and were much admired.

In the evening, Mr. Hodges entertained at dinner a select party of guests, when, after the removal of the cloth, speeches were made touching upon important topics, especially fire engineering.

EXPLOSIONS.

On Friday, March 21st, F. A. Able, Esq., F.R.S., director of the chemical establishment of the war department, read a paper on some of the "Causes, Effects, and Military Applications of Explosions," at the Royal Institution; the Rev John Barlow, F.R.S., Vice President in the chair.

A glance was taken at the general nature and causes of the phenomena termed Explosions, and attention was then specially directed to those explosions which are due to chemical agency.

In all instances of chemical action, accompanied by an explosion, the production and violence of the latter are either entirely or principally due to the sudden and very considerable development of heat, which results from the disappearance, for the time, of chemical activity. The violence of such explosions is therefore regulated by the energy of the chemical action, or the degree of rapidity with which the chemical change takes place. There are instances in which the change of state (*e.g.* the conversion of solids into vapours and gases), resulting from chemical action, and suddenness with which this transformation occurs would suffice to produce explosive effects, quite independently of the effects of heat developed by the change; but in all such instances the sudden increase in volume of the matter, resulting simply from the chemical change, is insignificant as compared with the expansive effect exerted, at the same time, by the heat developed in consequence of the sudden and violent disturbance of chemical equilibrium. Thus, the actual volume of gas produced on the decomposition of gunpowder, though very considerable in comparison with that of the original solid, is but small when compared with the volume which it occupies at the moment of its production, when under the influence of the intense heat resulting from the chemical change.

Explosions are occasionally produced by energetic chemical combination between elementary substances. Thus potassium combines with bromine with explosive violence, in consequence of the powerfully expansive effect of the heat resulting from the intense and sudden chemical action between the two elements. Again, the union of hydrogen with oxygen or clorine is so energetic, that the resulting water or hydrochloric acid is suddenly and enormously expanded by the heat developed; a powerfully explosive effect being consequently produced.

Explosions are much more frequently the result of chemical decomposition. Several classes of compounds are known, the unstable character of which endows them with explosive properties. Thus the compounds known as the cloride, iodide, and bromide of nitrogen are highly susceptible of instantaneous decomposition; the very slightest disturbing causes sufficing to destroy the chemical equilibrium which exists between their compotent particles. Compounds of silver and gold with nitrogen, hydrogen, and oxygen (fulmigating silver and gold), and silver and mercury with peculiar organic group, generally known as fulminic acid (the fulminates of mercury and silver), are also highly susceptible of sudden, and therefore violently explosive, decomposition. By the action of nitric and nitrous acids upon several organic bodies, compounds of highly explosive characters are produced, their formation resulting from the abstraction (by oxidation) of a proportion of hydrogen-atoms from the original body, and the introduction, in their place, of a high oxide of nitrogen. The products of the action of nitric acid upon starch and cotton, in different forms, are the best known of these; among others, the substances known as nitromannite (obtained by the action of nitric acid upon mannite) and nitroglycerine, or glonoine (the product of the action of nitric acid at low temperature upon glycerine), are remarkable for the violence with which they explode when submitted to friction or concussion. One of the most recently-discovered and curious of these explosive organic bodies is the nitrate of diazobenzol, obtained by the action of nitrous acid at a low temperature upon aniline. This substance explodes at least as violently as iodide of nitrogen and fulminate of silver, if exposed to a heat approaching that of boiling water; it is, however, far less sensitive to friction than those two bodies. Similarity explosive substances have been quite recently obtained by Dr. Hofmann from derivatives of the interesting and important base, rosanilline, the salts of which furnish some of the most beautiful of the colours now obtained from aniline.

Explosions are most readily produced by establishing chemical action between certain substances, greatly opposed to each other in their properties, and brought together in an intimate state of mixture. The substances applicable to the production of such mixtures are, on the one hand, bodies remarkable for their great affinity for oxygen; and, on the other, compounds containing that element in abundance, and partly, or entirely, in a loose state of combination. To the first class belong the elements carbon, sulphur, and phosphorus, and compounds of the last two, with readily oxidisable metals; the second class includes a few of the higher metallic oxides (such as the higher oxides of manganese and lead) and combinations of metals with nitric, chloric, and perchloric acids. Mixtures produced with these two classes of bodies readily ignite, or afford explosions, either upon the direct application of heat or by submitting them to friction, percussion, or concussion; and, in a few instances, by establishing chemical action in a small portion of the mixture, with the aid of some other compound. These explosive mixtures vary greatly in the ease which chemical action is established in the in the rapidity and violence of their transformation; their properties are naturally regulated by the chemical and physical characters of their constituents, and by the degree of intimacy of their mixture.

The variation in their explosive properties, and the great extent to which the characters of any particular mixture may be modified, are very important elements, in their application of practical purposes; while the comparatively instantaneous nature of the decomposition of explosive compounds, and the facility with which it is brought about, present very great, and in many cases insuperable, obstacles to their employment as explosive agents. By the comparatively gradual decomposition of an explosive mixture, such as gunpowder (when employed as a charge in a gun), the force exerted, by the gases generated in the confined space, discovers, before it attains its maximum, that portion of the chamber enclosing the powder (*i.e.* the projectile) which is separated from the remainder. By the motion which it immediately imparts to this, the *smaller* mass, the strain upon the *larger* mass, forming all but one side of the chamber (*i.e.* the breech of the gun), is at once relieved, while the force continues, to the close of its development, to act in the direction of the mass which has once yielded to its influence, and thus propels the projectile. The explosion of a charge of a fulminate, on the other hand, in a chamber of a gun, is so instantaneous that the maximum of force is at once developed, and the strain thus exerted within the chamber, at the same time that it overcomes the inertia of the projectile, (or the moveable side of the chamber), will also overwhelm the cohesive force which maintains the mass of the chamber entire, and the breech of the gun will therefore be shattered. Enclosed in a shell, a charge of fulminate will produce a much greater shattering effect than gunpowder upon the metal enveloped, reducing it to a much larger number of fragments; but the pieces of the shell, produced by employing gunpowder as the bursting agent, will be propelled with much greater violence, because there is still a development of force after the rupture of the shell, while, with the fulminate, the entire force is at once expended upon the bursting of the shell.

The very great extent to which the rapidity of explosion of gunpowder may be modified to suit different applications, is one of the most important properties possessed by this material. A very rapidly burning powder is necessary in many instances; for example, in shrapnell shells, in which the charge of powder is required to break open the shell without interfering, by any great dispersive effect, with the flight of the enclosed bullets or fragments of metal. In mortars, and short guns also, a quickly burning powder is required, as they afford a comparatively limited space for the combustion of the charge. If a slowly burning powder be employed in such arms, a portion of the unexploded charge is expelled, together with the projectile; the period between the first ignition of the powder, and the explosion of the shot or shell from the gun, being sufficient for the combustion of the entire charge. In long guns and in rifled cannon it is very important, on the other hand, that the ignition of the charge of powder should take place gradually, so that the pressure exerted thereby upon the gun and the projectile should, after the first ignition, be as far as possible uniformly continuous during the passage of the shot or shell along the principal portion, if not the entire length, of the gun's bore. With the gunpowder which has been, until quite recently, in general use for large cannon, the actual explosion of a charge is almost entirely accomplished before the projectile has passed beyond the trunnions of the gun. Hence the rear portion of the weapon is subject to a strain which is enormous as compared to that sustained by the front part of cannon. Numerous important advantages naturally result from a more uniform distribution of the pressure over the in- r of the gun; for instance, the necessity of ructing the part reaching from the breech to the trunnions of very much greater strength than the remainder (a measure which, in the production of cast-iron cannon, involves considerable difficulties) is greatly diminished, and the risk of fracture of guns, or of their serious injury from submission to excessive strain is considerably lessened. The explosive action of gunpowder may, it need hardly be observed, be easily regulated by the introduction of modifications in the proportions of the carbon, sulphur, and saltpetre employed in its manufacture, and in the degree of intimacy with which the ingredients are mixed. Both of these expedients interfere, however, with the extent of force ultimately exerted by a given weight of the gunpowder; since, in either case, the chemical action between the ingredients would be modified. The rapidity of combustion of gunpowder may, however, be admirably regulated, without introducing any alteration in its composition or in the perfection of its manufacture, simply by increasing or diminishing the size of the particles or grains constituting a charge; and also by modifying the degree of compression to which the gunpowder is subject before, or at the time of, its conversion into grains or pellets.

By combining the application of uniform and accurately regulated pressure with modifications in the composition of gunpowder, and by thoroughly confining the material within a case or receptacle, so that, if ignited, it can only burn in one direction, admirable and valuable arrangments (known as Fuzes and Time-Fuzes) are obtained for igniting charges of gunpowder in shells at any period, during their flight, which may have been determined upon previous to the loading of the gun. By simple mechanical arrangements, regulating the amount of the compressed gunpowder which shall burn before the flame reaches the charge in the shell, the time of explosion is readily adjusted with the greatest nicety (subject, however, to variations depending upon the degree of density of the atmosphere, as recently shown by Dr. Frankland's researches). The principle of regulated compression, and of combustion in one direction, is applied to the preparation of rockets, signals, and numerous pyrotechnic arrangements; other explosive mixtures being, in some instances, substituted for the gunpowder.

The advantages offered by materials of a much more powerfully or rapidly explosive character than gunpowder, when employed simply as destructive agents (for instance, in many classes of mining operations), have lead to repeated attempts at the application, as substitutes for gunpowder, of highly explosive mixtures, readily obtainable in large quantities, in which chlorate of potassa is employed, in the place of a nitrate, in conjunction with very oxidisable materials, such as the sulphides of arsenic and antimony, and compounds containing carbon and hydrogen (Callow's mining powder and white or German gunpowder are examples of such compounds). All attempts to manufacture and employ such mixtures have, however, invariably terminated in more or less disastrous results, in consequence of the comparatively low temperature at which chlorate of potassa exerts its oxidizing power. Very slight friction or percussion suffices to inflame many of these mixtures, and the violence of their explosive action is, in many instances, as difficult to control as that of explosive chemical compounds. Even in the manufacture and employment of comparatively so safe an agent as gunpowder, which may be subjected, without ignition, to tolerably powerful friction or percussion, and to the direct application of any temperature below that which suffices to ignite sulphur (about 550° Fah.), the neglect of strict precautions, for excluding the possibility of a particle of the powder being subjected to sudden and powerful friction, may, and frequently does, lead to accidental explosions. The occasional accidents in gunpowder manufactories are generally enveloped in mystery, in consequence of their fearfully destructive effects; in all cases, however, where it has been possible to trace the causes of such explosions, they have been found in the wilful or accidental neglect of simple precautionary measures, indispensable to the positive safety of the works and operators.

The more highly explosive mixtures, and some few explosive compounds, though inapplicable as substitutes for gunpowder, on account of their great sensitiveness to the effects of heat, have, in consequence of this very quality, received important applications in numerous ingenious contrivances for effecting the ignition of gunpowder. Well-known instances of such applications are:—The employment of fulminate of mercury in percussion-caps; of a mixture of chlorate of potassa and sulphide of antimony, in arrangements for firing cannon by percussion and by friction, and for exploding shells by percussion or concussion; and of the same mixture, exploded at will, by being brought into contact with a drop of strong sulphuric acid, for the ignition of submarine mines or of signals.

Other mixtures, combining a high degree of explosiveness with power of conducting electricity, have been successfully applied to the simultaneous ignition of numerous charges of gunpowder by electricity of high tension: by means of one of them, recently discovered, many mines may be simultaneously discharged, even by the employment of small magneto-electric machines; the necessity for the employment of voltaic arrangements in mining operations being thus entirely disposed with.

One of the most highly explosive mixtures at present known, consisting of chlorate of potassa and amorphous phosphorus, has been most ingeniously applied by Sir William Armstrong to the ignition of his time-fuzes, and to the production of concussion and percussion-fuzes, remarkable for the great ease with which they are exploded. The above mixture may be ignited by the application of a gentle heat, or by submission to moderate pressure; if it is made up into a hard mass by mixture with a little shellac-varnish, the friction resulting from the rapid insertion of a pin's point into the material suffices to ignite it, even when it is well covered with varnish. Thus, in Armstrong's time-fuze, which, when fixed in its place in the head of the shell, cannot, like ordinary fuzes employed in smooth-bore guns, be ignited by the flame of the exploding charge of powder (as the shell accurately fits the bore of the gun), the fuze-composition is inflamed, immediately upon the firing of the gun, in the following manner:—A small quantity of the phosphorus-mixture is deposited at the bottom of a cylindrical cavity in the centre of the fuze, and over it is fixed a small plug of metal, with a pin's point projecting from its lower end. This plug is held in its place by a pin of soft metal, which by reason of the *vis inertia* of the plug, is broken when the gun is fired, and the pin then instantly pierces the pellet of detonating mixture, which, by its ignition, sets into action the time-fuze. The distance between the pin's point and the phosphorus-mixture, before the explosion, is only one-tenth of an inch. This arrangement exemplifies in a striking manner the delicacy of action which may be obtained by a judicious combination of simple mechanical arrangements and highly explosive materials.

The variety of work accomplished by the explosion of a charge of powder in an Armstrong gun loaded with a shell—no less than five distinct and important operations being thereby effected before the shell leaves the gun—affords a most interesting illustration of the progress made in the application of explosives, and of the comparatively great control which may be exercised over the operations of those destructive agents.

Mr. Cunningham, the inventor of the system of reefing sails from the deck, has brought out a plan for protecting the screw propeller from fouling, a danger to which all ships of war carrying sail power are liable in action when losing masts or spars, from their floating alongside. Mr. Cunningham has fitted a small screw vessel on the plan, and has applied to the Lords of the Admiralty to fit one of her Majesty's ships to test the principle.

Digitized by Google

METEOROLOGICAL TELEGRAPHY.

(*Concluded from page 265.*)

Consecutive storms, at the meetings of main currents, in zones of latitude, at certain periods, have had appearances of continuity. The familiar instance of the "Charles Heddle" has so often been adduced as proof of continuing circuitous action, or gyration, that it may seem injudicious to doubt the evidence; but knowing how frequently circuits, or cyclones, succeed each other rapidly; and how unreliable are some of the earlier logs of events in a storm, written after its cessation, especially respecting directions of wind and courses steered, when waves and storm blasts were the guides, not the oscillating compass (if indeed that had not been washed away, as in the "Charles Heddle's" case); it does not appear accordant to experience, and enlarged acquaintance with the subject, to imagine that such atmospheric eddies are, *sui generis*, erratic, and so considerably independent, as to cross a wide ocean.

When opposing currents meet, their masses must continue in motion a certain time, either rotating, or ascending, or going onward horizontally in combination.

Masses of air, either of polar or tropical origin, so to speak, returning, when driven back by stronger opposition,—at first, and for a certain time, retain the characteristics of their peculiar and very different natures.

In our latitudes there is a continuous alternation of air currents—each specifically different, and denoting approach by marked characteristics: and we have proved by successive series of simultaneous statical observations, over a wide range,—embracing Scotland, Ireland, all England, and adjacent islands,—that while these alternating or circuitously moving currents are thus incessantly passing—the whole body of atmosphere filling our temperate zone is moving gradually towards the east—at an average rate of about five geographical miles an hour.

During strong westerly winds this eastward motion is greatly increased; and in easterly gales it is proportionally diminished, as measured by its passage along a horizontal surface of earth or ocean. Knowing these circumstances, and having accurate statical observations of these various currents, at selected outlying stations,—showing pressure (or tension), temperature, and relative dryness, with the direction and estimated horizontal force of wind at each place simultaneously, the dynamical consequences are already measurable approximately, on geometrical principles; and, judging by the past, there appears to be reasonable ground for expectation that, soon, meteorological dynamics will be subjected to mathematical analysis and accurate formulas. The facts now weighed and measured mentally—in what may be correctly called "forecasting" weather—are—the direction and force of each air current, or wind—reported telegraphically to the central station in London, from many distant stations; their respective tension and temperature, moisture or dryness, and their changes since former recent observations.

These show whether any or either movement or change is on the increase, or decrease—whether a polar current is moving laterally off—passing from our stations towards Europe—or approaching us from the Atlantic—whether moving direct towards the south-westward with great velocity, or with slow progress. If moving fast, in the direction of its length, it will approach England more from the east—its speed direct being from twenty to fifty or eighty miles an hour—while its constant lateral or easterly tendency (like a ship's leeway, in a current) being only five miles an hour is then insensible to us—(though clearly deducible from other facts ascertained), and is that much in alteration of actual direction, as well as of what would otherwise be the velocity of the polar current.

With the opposite principal current—the equatorial or south-westerly, more briefly and correctly tropical—similar but opposite results occur—the direct motion from a south-westerly quarter is accelerated—sensibly to our perception—by part of the eastward constant (about five miles hourly)—and therefore a body of air approaches us sooner (other things being equal) from the westward, than it does from the eastward.

To seamen accustomed to navigate in ships making leeway, while in currents setting variously over the ground, such movements, complicated as they may appear, are familiar. Another important consideration is the disposal or progress of bodies of air united, or mixed, or contiguous to each other, after their meeting—either directly opposed or at an angle—on the earth's (or ocean's) surface. They do not vanish:—they cannot go directly upwards—against gravitation;—westward they cannot generally go when there is collision or meeting, because the momentum, elasticity, and extent of the tropical "anti-trade" usually overpowers any direct polar current, or rises over it, and more or less affects the subordinate below, by the friction of its eastward pressure. Downward there is no exit—eastwardly (towards the east) the accumulating air must go—and this tendency continued causes the varieties of wind from the westward—being more or less mixed—more or less purely polar or tropical as either one prevails in combination.

After a body of air has passed, and gone to some distance southward or northward, it may be stopped by an advancing and more powerful mass of atmosphere which is moving in a direction contrary to, or diagonally across its line of force. If their appulse be gradual and gentle, only a check occurs—and the weaker body is pushed back until its special qualities, respecting temperature and moisture are so masked by those of its opponent as to be almost obliterated. But if these currents meet with energy—at very different temperatures and tension, rapid changes are noticed as the wind shifts—and circuitous eddies, storms, or cyclones occur.

Otherwise—when their meeting is, as first mentioned, gradual—there is the return of a portion of either current (which previously prevailed) either direct or deflected—deflected even through more than one quadrant of a circle—by its advancing opponent—and retaining for some considerable time its own previous characteristics.

Thus we have, for short times, cold dry winds from the south-west, instead of the usual warm and moist ones;—or winds of this latter kind from the north, instead of cold ones. The circuitous tendency of air in motion—and the numerous impediments to its horizontal progress, such as land, ranges of mountains, hills, or even cliffs—induced many a deviation from normal directions, extremely puzzling to the student of this subject; but so retentive is air of its tension and temperature, for a time, that, like currents in the ocean, each may be traced by its characteristics as long as within our island web of stations. When the polar current is driven back by a tropical advancing from a southerly direction gradually, their action united becomes south-easterly (from the south-eastward), and as the one or other prevails, the wind blows more from one side of east or from the other.

So retentive of temperature are oceanic currents, that when H.M.S. "Nile" was going from Halifax to Bermuda, in May, 1861, Admiral Milne found the temperature 70° at the bow,—while only 40° at the stern, as he entered the Gulf Stream.

Time is required to produce motion in the air—horizontally—time is indispensable for its gradual cessation from movement. Statical effects are noticed at observatories—or by careful observers anywhere—hours, or days, before dynamical consequences occur.

The present daily forecasts, or premonitions of weather, are drawn up on the following arrangement. Districts are thus assumed:—

1. North Britain (including from the Moray Firth to the middle of Northumberland) along the coast.
2. Ireland—generally—around the coasts.
3. Central (Wales to the Solway) coast-wise.
4. East Coast (from Northumberland to the Thames).
5. South England (from the Thames round to Wales) by the coast.

As our space is very limited, and as some words are used in different senses by different persons, extreme care is taken in selecting those for such brief, general, and yet sufficiently definite sentences, as will suit the purpose.

Such words as are on published scales of force, or nature of wind and weather, are generally understood, and therefore used in preference to others.

In saying, on any day, what the probable character of the weather will be to-morrow, or the day after, at the foot of a table showing its observed nature that very morning,—a limited degree of information is offered, for about two days in advance, which is as far as may be yet trusted generally, on an average, though at times a longer premonition might be given, with sufficient accuracy to be of occasional use.

Minute, or special details, such as showers at particular places, or merely local squalls, are avoided; but the general or average characteristics, those expected to be principally prevalent (with but few exceptions) the following day, and the next after it, including the nights—not those of the weather actually present—are cautiously expressed, after careful consideration.

It may now be seen, after many months' trial, whether tolerably correct forecasts of ordinary weather can be formed here sooner than at distant, isolated places, where the published general reports arrive a day or two later; and whether they are practically useful as conclusions available for the public.

Ordinary variations of cloudiness, or clear sky, or rain, of a local, or only temporary character, are not noticed usually.

A broad general average, or prevalence, is kept in view, referring to a day, or more, in advance, and to a district, rather than only to one time or place should be remembered.

The great practical difficulty is in separating the effect, on the mind, of present states of air, weather, and clouds, from abstract considerations of what may be expected on the morrow, or next following day.

When in doubt, distrusting the indications, or inferences from them (duly considered on purely scientific principles, and checked by experience) the words "Uncertain," or "Doubtful," may be used, without hesitation.

As meteorological instruments usually foretell important changes by at least a day, or much longer, we have to consider what wind and weather may be expected from the morning observations, compared with those of the days immediately previous, as indicative of the morrow's weather, and of the day after, at each place—to take an average of those expectations, for each district, collectively, in groups; and then to estimate dynamical effects.

Outline maps, with movable windmarkers, and cyclone glasses or horns, are useful in forecasting weather: and full consideration should be given to the probable position, direction, extent, and degree of progress of that centrical area, or node round which the principal currents usually circulate, or turn, as they meet and alter, combine with, or succeed one another.

Here dynamical considerations, with comprehensive comparisons of statical facts, are most important; and to treat them even approximately well, with such quick despatch as is requisite, demands aptitude and experience.

Those who are most concerned about approaching changes, who are going to sea, or on a journey, or a mere excursion; those who have gardening, agricultural, or other out-door pursuits in view—may often derive useful cautionary notices from these published expectations of weather—although (from the nature of such subjects) they can be but scanty, and imperfect, under present circumstances.

Objection has been taken to such forecasts, because they cannot be always exactly correct for all places in one district. It is, however, considered by most persons that general, comprehensive expressions, in aid of local observers, who can form independent judgments from the tables and their own instruments, respecting their immediate vicinity, though not so well for distant places, may be very useful, as well as interesting: while to an unprovided or otherwise uninformed person, an idea of the kind of weather thought probable cannot be otherwise than acceptable, provided that he is in no way bound to act in accordance with any such views against his own judgment.

Like the storm signals, such notices should be merely cautionary—to denote anticipated disturbance somewhere over these islands, without being in the least degree compulsory, or interfering arbitrarily with the movements of vessels or individuals.

Certain it is, that although our conclusions may be incorrect—our judgment erroneous—the laws of nature, and the signs afforded to man, are invariably true. Accurate interpretation is the real deficiency.

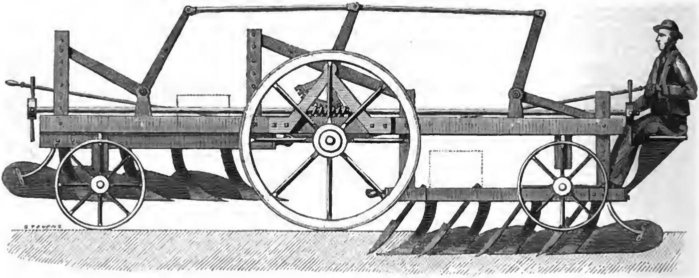
Seamen know well the marked characteristics of the two great divisions of wind, in all parts of the world, and do not care to calculate the intermediate changes, or combinations, of two or three points. They want to know the quarter whence a gale may be expected—whether northerly or southerly.

Every seaman will admit, that however useful, and therefore desirable, it would be to know exactly the hour of a storm's commencement—as our acquaintance with meteorology does not enable such times to be fixed—the next best thing is to have limits assigned for extra vigilance and due precaution, which limits are clearly stated, in all the printed popular instructions, to be from the time of hoisting the signal until two or three days afterwards.

But, say some, and justly—are ships to remain waiting to avoid a gale that, after all, may not happen? Are fishermen and coasters to wait idle and miss their opportunities? By no means. All that the cautionary signals imply is—"Look out." "Be on your guard." "Notice your glasses and the signs of the weather." "The atmosphere is much disturbed."

Many remarkable cases have occurred, which show the value of such warnings, or cautionary notices. Some have been published in newspapers, and need not be repeated; others have been communicated only by private letters; and one or two of [illegible] tioned now as instances.

STEEVEN'S STEAM PLOUGH.



Admiral Evans wrote that on one evening, after a warning had been given at Liverpool, such a sudden (though brief) storm swept over the Mersey as would have done much harm, had not the harbour-master made due preparations, because of the signal.

A gentleman intending to cross the Irish Channel with an invalid lady, was warned to wait, though the weather then looked beautiful in London. That night it blew a "hurricane" on the west of Ireland, and a gale in the Irish Sea, which lasted the following day.

Three ships-of-war were lying in Plymouth Sound, ready to sail for the West Indies. They waited two days, being cautioned, and then put to sea, in the intervening lull (as it happened), between two gales, the first of which was blowing while they were detained; and the second was a violent cyclone, that crossed France, the Netherlands, and Denmark, of which the northern semicircle swept our south and south-eastern coasts, but was just avoided by Her Majesty's squadron, or, rather, utilized by them, as they steered to the westward, nearly before its easterly wind, for some hours, and so passed out clear into the Atlantic.

Full warning was given along our eastern coasts of that storm in which the Prussian corvette Amazon was totally lost; and so struck were the Prussian authorities by the facts of that period—taken in connection with other known cases—that an official application was soon afterwards made to the Board of Trade for information, with the view of enabling a similar system to be organised in the Baltic, communicating, if possible, with England.

On the 12th of November, 1861, a warning was sent to Yarmouth, in the afternoon. Being nearly dusk—and having then no night signals—nothing was done till next day, after all the fishing boats had gone far out to sea—having started very early in the morning. That afternoon there was a storm; and to save their own lives, the fishermen were obliged to cut from and abandoned some £40,000 worth of nets and gear. Night signals might have saved that loss, and the imminent risk of many lives. Such means are ready now.

On Friday, the 7th of March, the warning drum was hoisted all day at Plymouth. Saturday was so fine, in appearance, that the caution was not appreciated, and mackerel boats went to a distance—as usual. That afternoon another signal was made—South Cone under drum—to show that a heavy southerly gale was coming soon. It was a beautiful afternoon. No one anticipated the sequel, except those who, spider like, could "feel along the lines." Before midnight there was a storm—which lasted much of the next day. One of the boats was lost with eight men. "A more dangerous gale had not been known," was written by an officer of experience and good judgment, in his letter to a friend.

Perhaps sufficient thought has not always been given to the consideration of mere pecuniary loss by wear and tear, risk, accident, delay, and demurrage,—caused by a gale at sea;—balanced against the results of waiting for a tide or two, perhaps once in two months, when cautioned by a storm signal.

But be this as it may, with coasters, short traders, or even screw colliers—the question is entirely different with ordinary over-sea or foreign-going ships—especially when starting from a southern, or from a western port. To such vessels a gale in the channel, or even during the first day or two after clearing the land, must always be very prejudicial. Officers and men are mutually strange. Things are not in their places; often not secured—and the ship, perhaps, is untried at sea. Of course, however, these remarks are inapplicable to fine first-class ships—and to powerful, well-managed steamers, independent of wind and weather, which start at fixed hours.

In conclusion, it appears that if due attention be paid on the coasts to cautionary signals—and at the central office—to the telegraphed reports—no very dangerous storm need be anticipated, without more or less notice of its approach being generally communicated around the British Islands; or to those coasts which are likely to be most affected by its greatest strength.

R. F.

STEEVEN'S STEAM PLOUGH.

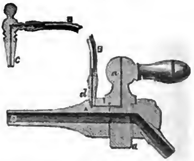
Mr. W. Steevens, of Godolphin-road, Hammersmith, has obtained a patent for an apparatus for ploughing and cultivating the land by steam. The apparatus, as illustrated in the above engraving, consists of a strong frame of wood or iron of suitable size for the number of ploughs or implements to be worked. Across the centre of this frame is fitted a strong wrought-iron shaft, which is made secure to each side of it, and upon this shaft is fitted a strong wrought-iron boss, having two projections, one on each side, for the purpose of fixing the main beams to. In order to carry the ploughs, grubbers, harrows, or any other implements, the frame is so arranged as to allow of the ploughs being "put to" or removed at pleasure, or any other kind of implement being used in the same way.

The frame with its central shaft supports the whole of the plough framing, and allows it to work freely by means of slides at each corner, which guide and keep it in its place as it rises and falls, by a rack and pinion fixed at each end of the plough for that purpose in connection with a lever, also answering the same purpose, and which is made use of in light soils where a great power is not required to raise the ploughs out of the ground. The whole of the frame and the ploughs are supported by one axle in the centre, but this axle is entirely independent of the frame and also the centre shaft upon which the ploughs are made to rise and fall, it being an ordinary axle with a drop-pin in the centre similar to the common carriage arrangement. Upon this pin the wheels are made to steer by means of lever or any other mechanical apparatus.

On the top of the main beam the inventor purposes to place a moveable box cistern or reservoir to contain liquid manure, water, or any other mixture that will act as a temporary lubricator, with india-rubber or other tubes, that a small quantity may continue to fall on the breast or mould boards when in stiff clay or heavy land, thereby causing them to pass through the land with much less power or draught; also the manure will be properly spread on the soil. The steel rope or chain passing through an eye or socket fixed on the cap of the centre wheel will pull the slack rope out on the unbroken ground into its place for the next draught or pull back.

The rope porters are so formed that the steel rope can pass over them without being lifted, there being a guide iron from the front, and a handle fixed to pull them back and forward fixed on a wood frame.

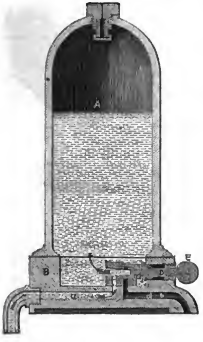
LEME'S VENT TAP.



It is well known that when wine or other liquid is drawn from a cask or other vessel, it is necessary to withdraw a vent peg at the top of the cask to admit air, and exercise a certain amount of pressure on the liquid. Two operations are necessary to accomplish this, one the withdrawal of the peg, the other the turning of the tap; the result is that in many cases the peg is forgotten to be replaced, the liquid is exposed to the atmosphere, and becomes deteriorated. The invention of M. Leme, of Paris, as illustrated above, completely overcomes this defect, as in the act of turning the tap opens or closes and at the same time admits or excludes the air according to the direction in which it is turned. The barrel of the tap is of the ordinary form, the key *a* has an aperture formed in it which, when the tape is open, is in communication by means of a flexible tube *b* with the vent peg *c* in the cask or vessel. Communication is established between the atmosphere and the interior of the cask or vessels by means of the continuity of the passage in the tap with that marked *d*, whereby the liquid flows from the cask. If a metal tube is used, the vent peg may be dispensed with and the tube itself fitted directly into the cask.

GREAVES' WATER REGULATOR.

(Patented by Mr. C. Greaves, of Old Ford.)



This invention relates to a peculiar construction and arrangement of apparatus for preventing waste of water from service pipes or cisterns, and consists of a closed air vessel, which is supplied with water from an ordinary service pipe, and is provided with a cock, which is so constructed, that when turned in one direction it will enable a supply of water to enter the air vessel, and partially fill the same; the air contained therein undergoing compression, and when turned in another direction it will shut off the supply entering the air vessel, and open the outlet from such vessel, the water then issuing therefrom with a certain pressure due to gravity and the air in the air vessel; by this arrangement it is obvious that the water to be drawn off for use must come from the air vessel and not from the service pipe direct, hence the liability of the water being wasted by leaving the cock open is obviated, as the contents of the air vessel only can be run off. In place of a single two-way cock, it is evident that two separate common cocks may be employed, but the preceding arrangement is much more convenient. In order to replace the air which may be absorbed by the water, an air inlet valve is fitted air-tight to the upper part of the air vessel.

The arrangement consists of a hollow conical plug having apertures made therein on opposite sides thereof, and in planes corresponding to the passages *A* and *B* respectivaly. and is provided with a square head, over which is fitted the square socket of a spindle *D*, passing through a stuffing-box, and having a key or handle *E* applied to the outer end thereof, for the purpose of turning the same.

The engraving represents the position of the cock when the apparatus is not in immediate use by the consumer; the inlet passaga *A* leading from the main to the air vessel being full open, so as to enable the vessel to be fully charged with water until the pressure of the water is balanced by the counterpressure of the air, which is compressed within the upper part of the vessel *A*.

In case it should be necessary to compensate for the absorption of the air in the air vessel by the water, or its leakage therefrom, a small air inlet or "sniffer" valve is fitted at the top, as shewn, which valve is made to open and admit a supply of air into the vessel should the pressure therein, when empty, fall below that of the atmosphere.

HUMPHREY'S IMPROVEMENTS IN STEAM ENGINES.

FIG. 1.

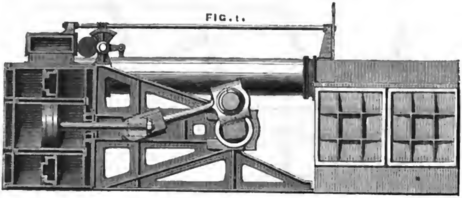
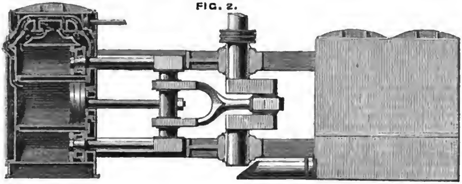


FIG. 2.



HUMPHREY'S IMPROVEMENTS IN STEAM ENGINES.

This invention, by James Humphreys, of Tower-hill, relates to improvements in the slide valves, and in the arrangement of the parts of compound steam engines. The first part of the invention consists of a novel description of a slide valve applicable to compound engines, whereby, with great simplicity of construction, considerable economy is effected in the transmission of the steam from the high-pressure to the low-pressure cylinder. The valve is a treble-ported slide valva; the laps at the extreme end of the valve cut off from, and supply to, the small cylinder the high-pressure steam from the boiler. The steam, after having acted on the piston of the small cylinder, is conveyed through a passage, forming part of the valve, into the large cylinder, which it enters and leaves for the condenser by the inner portion of the valve, which portion is an ordinary double-ported slide-valve.

The second part of the invention consists of improvements in the arrangement of the parts of compound engines, whereby great simplicity and accessibility are obtained. These engines may be vertical, but, arranged horizontally, are particularly adapted for driving the screw.

The small cylinder for the high-pressure steam is placed within the large cylinder, so that the outer piston is an annulus; this annulus has two rods, and the small piston has one rod; these three rods are attached to a cross-head working in guides, forming part of the main A frames of the engine; from this cross-head a connecting-rod, with a wide fork at the cross-head end, is attached to the crank-pin. The eccentrics and their rods for working the slides are placed outside the outer bearing of the main shaft.

Fig. 1 is a longitudinal section of the engine; Fig. 2 is a horizontal section showing tha arrangement of the piston rods, the cross-head and connecting-rod, and also the slide valve; Figs. 3 and 4 are enlarged views of the slide valve, Fig. 4 being a transverse section. The steam is admitted to the high pressure cylinder through the passage *a a*, and is conveyed from it through the passage *b b*, forming part of the valve, into the expansion cylinder through the ports *c c*.

ALEXANDER'S PATENT NEEDLES.

Mr. H. Alexander, of Washington, U.S.A., has patented a needle with a peculiar form of eye for preventing the thread or other sewing material from slipping therein whilst the needle is in use. This is accomplished by forming the eye of a wedge shape, so that when the sewing thread is drawn into the narrow part of the eye, it is securely retained thereby from slipping during the working up of the length of thread contained in the needle; at the same time by drawing it back into the wider part of the eye, the position of the thread can be readily changed, if desired.

IRON ARMOUR *VERSUS* ARTILLERY.

TO THE EDITOR OF THE "TIMES."*

Sir,—Having for more than twelve months read with interest the reports in the *Times* of experiments with heavy ordnance on armour-plated targets, I have observed that your reporter attaches more importanca to the attack than to the defence. He assumes that artillery must have the best of it against iron plates, and he loses no opportunity of asserting the supremacy of the former. The authorities seem to take the same view; in their anxious pursuit of the means of attack, they lose sight of the defence, apparently forgetting that the destructive effect of projectiles is to be measured, not by their positive force, but by comparison with the force of resistance they encounter. As this, in my opinion, is an unfortunate mistake which may lead to fatal national disasters, I wish, through the powerful medium of your columns, to draw public attention to the subject.

Early last summer, the *Times*, in its report of the first artillery experiments at Shoeburyness on the Thorneycroft bar target, under the direction of the Iron Plate Committee, explains that "those experiments were carried out for the purpose of fully testing the power of the old smooth bore and the new rifled gun against the strongest combination of iron plates and timber, consisting of a solid wall of iron ten inches thick." It asserts "that by the official detail the result of the experiments was *entirely* conclusive as to the immense superiority of rifled ordnance." And then it proceeds to state, "the heavy 68-pounder smooth-bore guns, made no perceptible impression, and it was evident that the battery would stand any amount of pounding from these weapons; in fact, after all the ammunition was expended, the wall of iron and timber appeared to be, for all practical purposes, indestructible. One of the Armstrong 120-pounder shunt guns was then placed in position, and fired with a projectile weighing 126 lbs. The extraordinary power of the weapon was instantly apparent; at a range of 600 yards, it *cleared out* one of the 10-inch plates, at the same time carrying away the back support. The next gun fired was one of the ordinary 100-pounder Armstrongs, with a solid projectile weighing 110 lbs. The battery was struck in another part, and a breach was made clean through the structure, the fabric itself being so weakened as to ensure its ultimate destruction. The result of a *third shot* was conclusive, as the whole fabric of the battery came down above the point struck, with a crash."

---

* Addressed to the *Times* but n

In the conclusions thus drawn from this experiment there is no hesitation or doubt, and we are distinctly told they are supported by official authority. Nevertheless, we now all know they are erroneous. The destructive effects on iron plates of the smooth bore 68-pounder, is greater than that of the rifled 100 or 120-pounder Armstrongs. This is proved by several experiments on the Warrior and other targets in which plates not of 10 inches but only of 4½ inches in thickness, were more extensively damaged by the former than the latter. Projectiles fired singly from the 100 or 120-pounder Armstrong are stated in the above report to have cleared out one of the 10-inch plates, and made a breach clean through the structure, but when fired against the 4½ Warrior plates, and 5-inch Fairbairn plates, these irresistible missiles did not even penetrate through the iron. They made only slight indentations on the surface, whilst 68 pounders also fired singly made deeper indentations, and damaged the plates with cracks more extensively. Fired in salvos, the Armstrong 110 lb. and 126 lb., and even the 200 lb. projectiles failed in "making a breach clean through the plates," much less did they "so weaken the structure, as to ensure ultimate destruction." I quote from your own columns. The *Times* of the 1st of August last, reporting experiments at Shoeburyness, says:—"The general result of the experiments has shown that the 5-inch iron plates of Mr. Fairbairn's target, attached to a ¾-inch skin, were perfectly able, so far as the plates are concerned, to withstand for a long time what was in fact a concentrated fire from the heaviest and most powerful ordnance in the world." On the 30th November the *Times*, for the first time, and six weeks after the event, gives some account of the trial of the Warrior target, which took place the 21st of October, and states "these great experiments prove that the plates and sides of the ship generally were practically invulnerable to the fire of artillery, no matter how concentrated. The fire of the most tremendous missiles, 100-pounders, 120-pounders, and even 200-pounder bolts (in volleys of threes, and fours, and sixes), were directed with a force and weight which appeared irresistible, but in vain. The shot flew off in rugged splinters, and the plates became almost red hot, but nothing more. As a rule, the 68-pounders left their mark in massive dents more deeply than the 100-pounder Amstrong."

On the 7th March the *Times* reports the trial of the Fairbairn target No. 2, which is constructed without teak planks at the back of the armour plates, which are in immediate contact with the skin. In other respects the target is on the same plan as that of the Warrior, the plates and frame being increased in strength to the extent of the weight of the 18 inches of teak of the Warrior. Before the experiments were concluded, before any salvo was fired, from the effect of vibration alone, caused by a few single shot at low velocities, the fastenings were destroyed.

I now come to the experiments at Shoeburyness on the 8th April on the Fairbairn No. 2 and the Warrior targets. In the *Times* of the 10th April, there is a curious contrast between the manner in which the two trials are reported. The former was fired upon during several hours with projectiles singly and in volleys, comprising 110 and 126-pounder Armstrong bolt and ordinary 68-pounder. The effects were remarkable, and deserved notice as evidence of the results of a system of backing different from that of the Warrior, but these experiments are dismissed with the remark that "the armour plates are bedded on hemp and india-rubber, and the effect of this soft medium in diminishing the force of the concussion upon the iron ribs beyond the plates, enabled it to stand much better. But the general feeling seemed to be that some kind of timber backing to the plates was indespensible. Heavy charges of powder and high velocities of shot are evidently the requisites for the destruction of iron frigates."

The grand feature of this report is the irresistible power of the new Armstrong shunt gun, which on this occasion was for the first time tried on the Warrior section. Four projectiles 156lb weight, of which two were fired with 40lb. and two with 50lb. charges, are described as having produced the most destructive effects, which are entirely attributed to the tremendous force of the gun, without any reference to the construction of the target. The language is almost identical with that of your report describing the effect of the 100-pounder Armstrong on the Thorneycroft 10-inch target, from which it was stated "the extraordinary power of the weapon was instantly apparent, a breach having been made clean through the structure," and yet this extraordinary weapon as a battering gun proved a failure.

The *Times* of the 18th instant reports further trials at Shoeburyness with "the new wrought-iron smooth bore Armstrong gun, against a target of three five-inch plates of wrought-iron bolted together; a mass of wrought-iron, in all 15 inches thick, or as nearly as possible four times the thickness of the Warrior plates. Two or three shots were fired against this, and each broke all three plates, cracking the first, ripping and splitting the second, and ripping the third, in such a way as to show that 15 inches of metal was an insufficient protection against ordnance of this description at close range."

Here, again, the destructive effects are attributed entirely to the Armstrong gun. Not a word is said of the nature of the structure as accounting for the "ripping and splitting," and no mention is made of the fact that 68-pounders fired at the same target on the same day, with 16 pounds of powder, produced the same ripping and splitting effects as the tremendous Armstrong.

From these extracts it is apparent that the conclusions drawn by your reporter from the experiments he witnessed, cannot be relied upon; and that there is now no more reason to believe the correctness of his inference from these last experiments of the irresistible power of the 156-pounder smooth-bore Armstrong, than of the so much vaunted 100-pounder from the earlier experiments. Your own reports thus prove, that before we can come to any right conclusion on the effects of artillery, we must fairly estimate the resisting force. So far as we know anything from experiments, they prove the weakness of the modes of armour-plating hitherto tried, but they prove nothing positive as to the destructive power of artillery against iron.

The Thorneycroft target broke down from its own weakness. It was a pile of bars tongued and grooved, and fitting into each other longitudinally without fastenings or cohesion, and without backing. In the experiments last year the bars were *pushed down* by the projectiles, and some were broken from vibration, but no shot penetrated the iron more than two inches, much less did they pass clean through ten-inch plates, as the words of your reporter would lead the reader to suppose.

The Warrior system in all its parts—tongueing and grooving the edges of the plates, through bolts, with heads exposed to impact and acting as wedges to split the plates, bolt holes through the plates, and wood backing—is avowedly a defective armour-plated structure. In the *Times* of the 1st August, it is thus referred to:—"The weak point, common to both targets, and to every other description of iron armour-plate that has ever been devised, is the mode of fastening either to the target or the ship's side. Every bolt hole in a plate is a source of weakness, as from them all fractures take their rise. This is the real point to which engineers should now direct their attention. The shape, thickness, and angle of plates best adapted for keeping out the shot, will then be very easily ascertained."

The damaging effect of bolt holes and through bolts is proved indisputably by the results produced on plates by the 156 lb. shot, each impact of that heavy projectile being followed by long and deep cracks, running from one hole to another, and by some of the bolts which were struck on the head having split the plates from top to bottom. But the grand defect of the Warrior plan is the teak backing. Wood affords no support to the back of the plates; it forms, in fact, a bed to facilitate punching through the iron.

Of these circumstances no account is taken by your reporter, nor has he ever mentioned an experiment of the Iron Plate Committee, which proved that a 100-pounder rifled Armstrong gun could make no impression on a 2½-inch plate backed with iron. This once redoubtable weapon is, by the admission of Sir William himself, eclipsed, as a battering gun, by the old smooth-bore 68-pounder. It may turn out that iron armour, constructed on better principles than that of the Warrior, will be invulnerable to 156-pounder shot, fired with 50 lb. of powder, and even to heavier projectiles, with greater charges.

It is unwise and dangerous to assume that the destruction of the Warrior target in the late experiments is to be ascribed solely to the new Armstrong gun, when there is reason to believe that the real cause of the success of the gun on that occasion was the weakness of the structure against which it was fired.

A CIVILIAN.

A REJECTED COMMUNICATION.

The following letter was addressed to the Editor of the *Morning Star and Dial*, but not inserted:—

SIR,—I read with surprise the leading article in your impression of Saturday, on the Lambeth election and street tramways. You recommend that the election should turn, not on the general fitness of the candidate, but on the particular views he may entertain on the rights of the Lambeth vestry to authorise the construction of tramways. In your haste to vindicate local freedom you scarcely do justice to the rights of the general public. You appear to forget that trial by jury and acts of Parliament are as much entitled to respect as the decisions of a vestry. You say that "a mere matter of taste is elevated into a grave constitutional question. The issue raised has nothing to do with the comparative convenience of various modes of locomotion." I agree with your premises, but totally disagree with you in your conclusions.

The road between Westminster Bridge and Kennington Park may be called one of the great arteries of London. It is a great public thoroughfare; it does not belong to the people of Lambeth merely, or even to the people of London, but to the people of England. A Lambeth vestry cannot do what they like with that road because the ratepayers of Lambeth pay for repairing it. If they possessed the power to authorise the construction of *one* tramway, they can authorise the construction of two or more tramways, until no part of the road would be available for general purposes. If they can say that a tramway should be put down, they can also say when it should be taken up, whether it be a public convenience or not.

Kennington-road is as important to south London as Fleet-street is to the city. Fleet-street, like Kennington-road, is the Queen's highway, and is the common property of the British people. Do you think that because the ratepayers of St. Dunstan pay, or partly pay for repairing Fleet-street, the vestry of St. Dunstan can do what they like with that street? Can they authorise tramways to be put down and taken up just as it may suit their interests or caprices? Certainly not. Did they possess such a power, Parliament would be justified in taking it from them. Fleet-street, being a public highway, should be under public control, and subject to laws passed, not by a parish vestry, but by the Imperial Parliament. But you, sir, according to the argument in the article referred to, would subject national rights to local laws, and build up parochial pretensions on popular liberties. As you say, "it is a grave constitutional question," and *other* electors must be consulted besides those of Lambeth. But I will not do the electors of Lambeth the injustice to suppose that they would wish to promote local interests, or follow local inclinations, at the expense of usage and law.

Possibly a tramway in Fleet-street would be a public benefit, or it might be a public nuisance. But who shall judge? Shall the local vestry decide, or shall the people who have an imprescriptible right to pass through Fleet-street, have a voice in the decision? Suppose a tramway laid down in that street in obedience to local authority, and suppose that tramway to be considered a nuisance by the millions who pass through that street. Is the convenience of millions to be sacrificed to the vote of a vestry? But suppose the tramway to be a benefit to the majority and a nuisance to the minority only. Is it for a vestry to say that the convenience of the minority must yield to the convenience of the majority? At that rate, the vestry would wield imperial power, and the privileges of the public would be at the mercy of an irresponsible few. The argument which applies to Fleet-street applies with equal force to Kennington-road. Nothing less than an Act of Parliament should say that the comfort of the individual must give way to the public good. I know nothing that should be guarded with more jealous care than public roads which are the common property of all. A railway, which passes through fields, cannot connect two towns without the sanction of Parliament; and shal

Digitized by Google

a railway be planted on the Queen's highway at the bidding of a parish vestry? Well might you say, sir, that "the issue raised has nothing whatever to do with the comparative convenience of various modes of locomotion." Whilst I would maintain the rights of local legislation intact, and guard with scrupulous care even the parish beadle's cocked-hat, I would not for a moment surrender one jot or tittle of the citizen's rights on the public highways of England but in obedience to public law. Let the South London Tramway Company get an Act of Parliament, and then they need not fear the votes of vestries, or the verdicts of juries. The Lambeth vestry in authorizing the construction of the Kennington-road tramway, went beyond their jurisdiction, and the Surrey jury re-asserted the validity of the law, and re-secured constitutional rights from the usurpation of local power.

It is not my province, just now, to speak of street tramways, any more than to say that I believe, in many parts of the metropolis, they would be public benefits.

I was present at the trial at Kingston, and am of opinion that the jury exhibited an indecent haste in deciding without hearing the evidence on the other side, and in so doing they materially weakened the moral effect of their verdict.

I am, sir, yours, &c.,

J. Passmore Edwards.

166 Fleet-street, E.C., April 21, 1862.

Proceedings of Societies.

ROYAL INSTITUTION.

MAUVE AND MAGENTA.

Dr. A. W. Hofmann F.R.S., gave the Friday evening discourse, on the 11th inst., his subject being "Mauve and Magenta, and the Colours derived from Coal." The starting-point of this new branch of industry was the manufacture of coal-gas, the principal features of which were explained by the aid of two large diagrams shewing the retort-house and condensers of a gaswork, and illustrated by an experiment on a small scale. The distillation of coal was performed in a glass retort, and the gas collected in a glass gas-holder, the gas tar being condensed in a small glass globe and collected in a glass flask placed between the retort and the gas-holder. Abandoning the gas and coke as not pertaining to his subject, the lecturer proceeded to explain the chemical nature of the coal-tar by the aid of large diagrams, containing a long series of hard names, representing the various compounds which had been separated from it. The number of these substances is still daily increasing, owing to the fact of their formation being due to the influence both of the temperature of distillation and the composition of the coal, which was shown by a diagram to vary to a considerable extent.

Dr. Hofmann next endeavoured to give a popular idea of the nature of destructive distillation. After referring to some of the principal types of matter which chemists have recognised—such as hydrogen, water, and ammonia, he produced three wire frames, which, when filled with cubes of different colours, represented these types. By taking the atoms of hydrogen, oxygen, and nitrogen out of these type-moulds, and replacing them by atoms of chlorine, sulphur, and phosphorus, the relation of hydrochloric acid and of sulphuretted and phosphoretted hydrogen to hydrogen, water, and ammonia were explained. In a similar manner, the insertion into the type-moulds of cubes representing the compound atom ethyl, the formation of ethylated hydrogen, of the ethylated waters, alcohol and ether, and of the three ethylated ammonias were exhibited. By substituting cubes which represented the compound atom, phenyl for the ethyl, Dr. Hofmann showed the constitution of phenylated hydrogen (benzol), phenylated water (phenol), and of phenylated ammonia (phenylamine or aniline)—the three bodies chiefly concerned in the manufacture of colours from coal-tar.

He then proved experimentally the formation of hydrogen, water, and ammonia, in the distillation of coal, and explained how all the numerous bodies existing in coal were formed by the substitution of compound atoms, consisting of carbon and hydrogen for the hydrogen in the types. The quantity of aniline in coal-tar being very small, the possibility of obtaining it from benzol was next considered; and the transformation of the latter into nitro-benzol by means of nitric acid, and, lastly, of nitro-benzol into aniline by means of iron and acetic acid, was illustrated by experiments. On adding a solution of chloride of lime to aniline the liquid was shown to assume a deep *mauve* colour. This colour has long been used by chemists as a test for aniline; but a few years ago Mr. W. Pekin had the happy idea of investigating the circumstances under which this colour, so remarkable for its instability could be obtained in a permanent state, and applicable for dyeing purposes. This result be obtained by oxydising aniline with bichromate of potash and sulphuric acid, and the colour thus obtained, known by the name of *aniline purple*, has been highly prized as a dye—its value being weight for weight equal to that of platinum. (A magnificent piece of aniline purple and solutions of various strengths, contributed by Mr. Pekin, were exhibited.) The composition of the colour was as yet unknown, and its formation unexplained.

By oxydising aniline by means of other agents than chromic acid—such as nitric acid, nitrate of mercury, chloride of tin, &c.—the beautiful crimson dye called *magenta* is produced, as was shown by experiment. Aniline crimson, originally observed during scientific inquiries, was first prepared on a large scale by Verguin, and has since been largely manufactured in France and in this country; and to Mr. Nicholson, of the firm of Maule, Simpson, and Nicholson, is due the credit of having brought this branch of industry to its present state of perfection. The chemical nature of magenta is better known than that of mauve. Magenta (named by chemists rosaniline) is a base, colourless in the pure state, but when combined with acids, yielding beautiful salts of a magnificent green lustre, like that of the wings of the rose-beetle, and, when dissolved in water, the splendid colours of magenta. Dr. Hofmann showed these phenomena by preparing the acetate of rosaniline, and exhibited a magnificent specimen of this extraordinary body in the form of a crown, which Mr. Nicholson had grown in a solution containing about £8,000 worth of magenta.

The rest of the lecture was devoted to a series of experiments illustrative of the manner of dyeing with the new dyes. Wool, silk, and fabrics consisting of linen and wool or linen and silk, were died not only with mauve and magenta, but also a new purple colour lately discovered by Mr. Nicholson. In referring to the morale of the subject, Dr. Hofmann reminded the audience that benzol, the chemical basis of the new colours, was discovered in the laboratory of the Royal Institution, by Professor Faraday, in 1825, and shewed the original specimen. He referred to the production of mauve and magenta as illustrations of the practical results which almost invariably follow pure scientific research, and entreated his audience not to cool the ardour of chemical inquirers by asking the too frequent question, "What is the use of your experiment?" but to let them indulge in the pursuit of truth for its sake alone. The gallery of the theatre was adorned with magnificent specimens of fabrics dyed with mauve and magenta, contributed for the occasion by Messrs. Perkins and Sons, and Messrs. Maule, Simpson, and Nicholson.

LIVERPOOL POLYTECHNIC SOCIETY.

The last monthly meeting of this society was presided over by Mr. Arnott. A paper was read by Mr. T. Ashmore on "The Application of Machinery to the manufacture of Bread." In this essay the author expressed his opinion that machinery might be introduced into the manufacture of bread with advantage both to the seller and the buyer. The President then read a paper on "The Drainage of Haarlem Lake, in connection with the Embankment and gain of Land in Britian." Colonel Clay next delivered an address on "Projectiles and Iron-plated Vessels." The address was illustrated by diagrams. It alluded to the conflicting opinions which have recently prevailed as to the relative efficacy of the offensive or defensive means of conducting naval war. Within a comparatively short time it had been believed that properly constructed iron-plated ships, or floating batteries, were the most efficient means of defence, as they were supposed to be impregnable; the recent experiments at Shoeburyness, however, had once more turned the tables and restored powerful ordnance capable of sending large projectiles at high velocities to the place in public esteem, which they had hitherto occupied as the best means of ensuring safety to our shores. He at some length discussed the relative merits of smooth bore and rifled guns, shewing that, at short ranges, or as they are denominated initial velocities, the former have an advantage; but that advantage is completely negatived at long ranges, in which the original velocity of the rifle ball is found to be sustained throughout a great distance, whereas the smooth bore round shot loses its impetus at a comparatively high rate of diminution. Colonel Clay next adverted to the question of iron-plated ships, expressing, however, his reluctance and inability to speak on questions of ship-building. He expressed his conviction that testing a model only gave no satisfactory information on so important a subject. He had no doubt that we can easily increase the size both of our means of offence and defence. He saw no immediate limit to the size of iron-plates, and alluded to one which had been forged at the Mersey Steel and Iron Works, 6 feet 3 inches in width, a description of which was given in last week's *Albion*. In conclusion he expressed his conviction that so long as the sons of England, as at present, grudge not their time, their money, and their blood, so long will England remain the first and foremost of the nations of the world, and the "home of the brave and the free." Some discussion ensued, in which several of the members took part, at the conclusion of which thanks were cordially voted to Colonel Clay, and the proceedings terminated.

MEETINGS FOR THE WEEK.

Mon.—*British Architects*, "On Jewish and Roman Architecture in Palestine, from the earliest period to the time of the Crusades," by Signor Pierotti, at 8 p.m.
Medical Soc., at 8.30 p.m.
London Inst., "On Birds," by R. Owen, Esq., at 7 p.m.

Tues.—*Inst. Civil Engineers*, I. "On reclaiming Lands from Seas and Estuaries," by J. Oldham, Esq. II. "On the reclamation of Land from Seas and Estuaries," by J. H. Muller, Esq. III. "On the Sea Dykes, Slesrug and Holstein, and reclamation of Land from the Sea," by J. Paton, Esq., at 8 p.m.
Royal Inst., "On the History of Ancient Art," by C. T. Newton, Esq., at 4 p.m.

Wed.—*Society of Arts*, "On the Silk Department of the Italian Exhibition, held at Florence in 1861," by T. Winkworth, Esq., at 8 p.m.

Thur.—*Linnean*, at 8 p.m.
Royal Soc., at 8.30 p.m.
Architectural Association, "Painting and Painters in England from 1760 to the present time," by Mr. H. Ottley, at 8 p.m.
Antiquaries, at 8.30 p.m.

Fri.—*Royal Inst.*, R. Monckton Milnes, Esq., M.P.
London Inst., "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.

Sat.—*Royal Inst.*, "On Agricultural Chemistry," by T. Anderson, Esq., at 3 p.m.

TO CORRESPONDENTS.

Received.—T. M., J. A. S., J. H. P., W. A., D. M. T., H. H., W. C. and Son, Capt. N., C. and Co., J. F., C. T. C. (not new, Commander Scott has invented and applied a similar plan), G. C., C. B. K., W. H. C., S. L., W. H., "A Northampton Subscriber," A. G., J. H., J. H. G., W. W., W. H. and Co., R. and G., E. G. Brest, G. M., Capt. W. C. (next week), "Our Iron Navy."

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

RED SEA TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Victoria-street, April 22, 1862.

Sir,—Referring to a recent article headed "Telegraph to India Company," and to Mr. Glass's letter in your last number, respecting Mr. Latimer Clark's reports as to the condition of the cable at the upper part of the Red Sea, I beg to inform you that Mr. Clark has *not* discovered any submarine hot springs or volcanoes there, and I shall be very much surprised if he ever does in that locality.

What Mr. Clark really writes on the subject is as follows. After speaking of part of the cable coming up in good order, he says:—

"The latter portions of the cable were not so good as the first; many of the wires were eaten quite through by rust, and in one instance all of them, the gutta-percha alone remaining; the yarn is sound and strong, and the gutta-percha as good as new. There are, however, several most astonishing evidences of the cable after manufacture having been submitted to considerable heat, the gutta-percha having lost its form, and taken that of the external wires. In some places the gutta-percha has been so much softened as actually to ooze through the interstices of the yarn, and fill up the crevices between the external wires. On seeing such faults the only ground for surprise is how the cable ever worked at all, and not why it failed; at the same time they are very cheering for the future of submarine telegraphy, for such occurrences are impossible henceforth. I should have been disheartened to have found any obscurity or doubt about the causes of the failure of the line, but I am sanguine that they will be found perfectly patent and obvious throughout."

You may be interested to know that Mr. Clark left Aden, on the 2nd instant, in the steamer Sir James Duke, with two hundred miles of cable, and all the necessary appliances and staff for trying to repair the line towards Kurrachee, upon which he will work until the commencement of the monsoons.—I am, Sir,

Yours most obediently,

Charles T. Bright.

THE MESSINA STEEL BRIDGE.

Sir,—In your impression of the 21st of March last, you have inserted a letter signed "Civil Engineer," dated from Katesgrove, Reading, 15th March, respecting the steel from which the great suspension bridge at Messina is to be manufactured. The writer Mr. John Box, for many years an enthusiastic admirer of the steel I manufacture, seems to have forgotten to say that the order for this bridge came, in the first instance, to us, but, being on too large a scale for the present capabilities of our work, we assigned the execution of the order, when finally resolved upon, to Mr. William Butcher, junior, of the Rutland Works, Sheffield, the license of our patent processes for the manufacture of cast steel and homogeneous metal, and the steel which bore 70 tons tensile strain as compared with the Bessemer metal of 50 tons tensile strength, was our patent cast steel, manufactured by Mr. William Butcher.

Mr. Box is, however, quite right when he says that we need not look to Prussia for cast steel, for steel of a quality superior to Mr. Krupp's is manufactured at our works, and we are about to increase our make to 300 tons per week, thus demonstrating, on the largest practical scale of operation, that England contains within herself all the elements and materials requisite to render her independent of any foreign supply of steel or steel-making material.

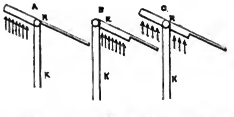
Robt. Mushet.

Coleford, 22nd April, 1862.

◆

RUDDERS.

Sir,—At the meeting of Naval Architects held on the 27th ult., Captain Halsted, R.N., stated, without contradiction, that in our long iron screw frigates the rudder can only be put to an angle of 15° with the keel out of 40°, and to produce this angle, even, it requires eight men at the wheel, whose power is increased by mechanical purchases to that of 160 men, thus increasing the time necessary to move the rudder twenty fold.



I take the liberty to offer the following suggestions, which, if carried out, would, I think, overcome the difficulty. In looking over the stern of the ship let figure *A* represent a rudder hung in its usual way on its fore edge, in the three figures *K* to represent the keel of the ship, and *R* the tiller and rudder, figure B a rudder hung upon its after edge, that is, in a diametrical opposite manner, and let the arrows represent (say one ton each,) the rush of water striking the face of the rudder; in the case of *A*, it will require a power to overcome the seven tons of pressure to put the helm hard-a-port or hard-a-starboard, but *it will come amidships without assistance.* In the case of *B* it will require the same power to put the helm amidships, but *it will go hard-a-port or hard-a-starboard without assistance*, with, in both cases, a strain on the rudder head of more than fourteen tons, this brings me to figure *C*, representing a rudder hung as I propose, near the centre, between the fore and after edges, so as to let, say four tons, to strike upon the part abaft the pivot, and three tons on the part before it, in this case I think it will be seen that the power required to put the helm hard up, would be only that necessary to overcome one ton of resistance, this, if I am right, would reduce the strain upon the rudder head to little more than eight tons in lieu of fourteen, and would reduce the time necessary to move the helm from twenty minutes to one or two (or any other part of time in equal proportion), at the same time permitting the helm to be put to its most efficient angle without difficulty or danger.

In connection with this subject allow me to say, that in my opinion no single rudder will be found sufficient for these ships under trying circumstances, and I should propose their being fitted with an auxiliary rudder in the bow, this of course not to be used except when in a difficult navigation, or in a gale of wind when the stern rudder will not keep the ship's head up to the sea, and it is my firm opinion that if the Great Eastern had had this assistance, that she would have escaped all her late damage she experienced, and the still greater loss of prestige. I take it that two rudders thus placed would have much greater power over the ship then one only whose size was equal to them both, as the leverage to be overcome would be divided into halves. At the meeting above mentioned I had a rough model upon the table, shewing the rudders here advocated, but amongst so many very interesting things, I must confess that it attracted little or no attention.

I am, Sir, Yours truly, Half Pay.

Hammersmith, 9th April, 1862.

◆

CAST STEEL FOR GUNS.

Sir,—No practical man who has had opportunities of examining and testing the nature and quality of cast steel can for a moment doubt that cast steel alone is the proper material from which cannon ought to be manufactured. Nothing but strong prejudice, backed by stronger private interest in high quarters, could for a moment sanction the adoption of built-up wrought-iron and steel guns, and cast-iron cannon, with all their notorious imperfections, in place of the cheap and perfect artillery which can be forged out of cast steel. Nevertheless, time passes on, and built-up guns and cast-iron cannon divide the attention of Government, and swallow up millions of the national income, whilst the object to be obtained remains as distant as ever.

Smooth-bore cast-steel guns are all that are required unless as merely matters of curiosity, for, except as regards their extraordinary range, the rifled cannon are in all other respects inferior to the smooth-bore gun, whilst to suppose that battles are to be hereafter fought between armies separated by a distance of several miles is simply absurd, and the great length of range is consequently unimportant.

Ultimately, no doubt, the smooth bore will be adopted, and cast steel alone will be the material from which guns hereafter will be forged. The best cast steel for guns is that which possesses an intermediate quality, neither exhibiting the brittleness of cast-iron, nor the toughness accompanied with the softness of copper. There should be a sufficient degree of tenacity to render the gun perfectly secure from bursting, and the metal should at the same time be hard enough to ensure that amount of resilient elasticity which alone can ensure the bore of the gun remaining unimpaired and unaltered after repeated discharges. The Bessemer metal does not, I think, possess these requisites. It is as tough as copper, but nearly as soft also, and guns made from it would soon stretch and widen in the bore from the expansive force of the discharge, for they would, in fact, be far softer than wrought iron of good quality—such, for instance, as the Lowmoor iron.

The blooms or ingots of Bessemer metal are also exceedingly hollow and cellular, as the annexed examples will serve to shew; and though the hollows or cells are more or less closed up in the forging of the bloom or ingot, their surfaces do not unite, and they remain as so many imperfections in the forgings produced from these ingots.

Bessemer ingot	No. 1	Length	29 in.	Area	6×6 in.
,,	No. 2	,,	30 ,,	,,	6×7 ,,
,,	No. 3	,,	21 ,,	,,	6×6 ,,
,,	No. 4	,,	31 ,,	,,	6×6 ,,
,,	No. 5	,,	24 ,,	,,	12×12 ,,
,,	No. 6	,,	24 ,,	,,	12×12 ,,

Weight of solid.	Actual weight.	Deficiency.
No. 1 ingot, 298 lbs.	170 lbs.	128 lbs.
No. 2 ,, 360 ,,	202 ,,	158 ,,
No. 3 ,, 318 ,,	208 ,,	110 ,,
No. 4 ,, 318 ,,	190 ,,	128 ,,
No. 5 ,, 988 ,,	766 ,,	222 ,,
No. 6 ,, 988 ,,	718 ,,	270 ,,

In these examples I give the length and dimensions of each ingot and its actual weight, giving also its proper weight of solid, the difference in these weights indicating the amount of honeycomb or cellular structure in each ingot. It is evident that a gun forged from a similar ingot of steel would necessarily be very unsound, and not at all to be relied upon even if the extreme softness of the metal itself did not render it liable to stretch under the expansive force of the discharge. It does not, therefore, seem at all probable that the Bessemer process is going to supply that quality of cast steel best adapted for artillery.

22nd April, 1862. W. S. P.

◆

THE HARTLEY BEAM.

Walker Ironworks, 17th April, 1862.

Sir,—In a paper that was read before the members of the London Association of Foremen Engineers, Mr. Oubridge informs the members that the Hartley beam was an open sand casting of irregular thickness as regards bosses and ribs, and the power of supplying the requirements of crystallization by heads of pressure was absent at the time of its formation. I beg to inform your numerous readers in general, and Mr. Oubridge in particular, that such was not the fact, but that it was a covered casting, moulded with great care, properly dried, as dry-sand castings of such proportions are, duly covered with loam plates, and weighted with heads and runners 15 inches higher than top of beam, to secure greater density of iron, and that every care was taken by the firm and their agents, regardless of expense, to secure a first-class casting. As regards the irregularity of the beam, I may observe that one of the most practical moulders in the north considers the section of the beam very well proportioned for an equality of contraction.

Founder.

◆

SUBMARINE RECOVERY BUOY.

Sir,—In your list of patents, published in No. 2482, I find you have given the wrong name to the patentee, viz., N. tt. Payne; this should be Wm. H. Payn.

I send you a prospectus of the invention, and shall be obliged by your correcting the name of the trustee of the patent, and adding the real name of the inventor as it stands on the patent, namely, "A communication from Elton Templemore, Civil Engineer, Marine Department, Madras."

A model of the submarine recovery buoy will be exhibited at the International Exhibition.

Yours faithfully,
William H. Payn, Coroner, Dover.

22nd April, 1862.

◆

14 St. Jean D'Acre Terrace, Stoke, Devonport,
April 23rd, 1862.

Sir,—Please let the following *errata* appear in your next impression in relation to the "Tangentiality of Rifle Projectiles," which appeared in your Magazine of the 11th instant:—Line 18 from top, for "spheriod," read "spheroid." Line 6 from bottom (under diagram), for "cylindro-ogical," read "cylindro-ogival," and same elsewhere. Line 2 from top of last column, for "*or* the congreve rocket," read "*as* the congreve rocket." And, finally, for "*B.* W. Woollcombe," read "Your obedient servant,

"*R.* W. Woollcombe."

Gossip.

◆

The jurors appointed to adjudicate upon the claims of exhibitors in the horological department of the Great International Exhibition comprise Professor Airey, Astronomer Royal; Mr. Charles Frodsham, Strand: Mr. E. D. Johnson, Wilmington-square: and Mr. Haswell, of Percival-street. There is no doubt that the awards of these gentlemen will be satisfactory, although the task of making them is to a certain extent a thankless one under almost any circumstances.

The Corporation of the City of London have granted the use of Guildhall, with the courts and offices adjoining, for the purposes of the sixth annual meeting of the National Association for the Promotion of Social Science, to be held in London, from the 5th to the 14th of June next.

The Commissioners of Sewers for the City having decided upon the repavement of the Poultry from the point at the western end of Cheapside to the Mansion House, have given instructions to the engineer to try as an experiment the laying down of iron squares curiously corrugated, but so formed on the surface apparently as to give good foothold for the horses. How that may prove, of course, has to be tried. An experiment with iron pavement was made a few years since, but independently of the ill-fitting form of the blocks it was so imperfectly laid as to become shaky in a very short time, and consequently useless. In the present case on each side of the carriage way iron trams for the wheels of the vehicles to roll over of about 18 inches in width are being laid. These are of the same kind as those put down some time since in Fenchurch-street, and which have been found to answer perfectly.

While the question is yet pending as to what kind of memorial shall be raised to commemorate the virtues and perpetuate the name of the Prince Consort, a gentleman named Keyse is forwarding a scheme for the erection of a "Grand national, naval, and military trophy to Her Most Gracious Majesty, Queen Victoria, and his late Royal Highness, the Prince Consort, Field Marshal, &c., &c., &c." Whether this remarkable notion may ever be realized or not is to us a problem. Its promoter, however, seems quite in earnest; for he has published a pamphlet, in covers of blue and gold, descriptive of his plans, and opened an office near St. Martin's Church, Charing Cross, for the receipt of subscriptions to carry them into effect. From the rather grandiloquent and not very grammatical language of his pamphlet, we gather that Mr. John Keyse proposes to have the "Trophy" erected "within the enclosure at the east end of the lake, in front of the Military Parade, St James' Park," and that it is intended "to commemorate and hand down to posterity Her Majesty Queen Victoria's most noble, gracious, and magnanimous acts towards her royal navy and army. Also to perpetuate to posterity the naval and military achievements victoriously gained during the past century; and the future acts that may *hereafter* be performed by their invincible and heroic deeds of valour, obtained by sea and land throughout the universal globe" (!). If this be not sufficient to call forth contributions from all quarters, the days of patriotism, like those of chivalry, must surely have passed.

The new coaling jetty in course of formation at Devonport dockyard is in a very forward state, and will probably be completed by the end of June. It will afford excellent accommodation for supplying the navy with coals, an advantageous means of effecting which does not now exist at Devonport. The jetty will be 400 feet in length by 40 in width, and is, in fact, an extension of the present anchor wharf. The piles upon which it will stand are of cast-iron, and about 40 feet long. They terminate in sharp points at their lower ends, and are driven by "monkeys" of a ten weight each into the solid rock which forms the bed of the harbour. Messrs. Henry, Grissell and Co., of the Regent's Canal Iron Works, London, are the contractors for the coaling jetty, and it argues well for them, and for their manager at Devonport, Mr. Gideon Scott, that in spite of winter weather, and the practical difficulties in the way of pitching and driving piles in deep water and into hard limestone, they have made so much progress in so short a time.

Digitized by Google

Mr. John M. Oubridge will read a paper before the *Association of Foremen Engineers*, on Saturday, the 3rd prox., at 8 p.m., on "CARBONIZING CAST IRON FOR ARMOUR PLATES."

Aneline colours, when dissolved in alcohol, and thickened with varnish, have been used with success in tinting albumenized photographs, and are suitable for transparencies on glass.

Mr. E. W. Blake, of New Haven, U.S., has detected the existence of the new metals, rubidium, and cæsium, in triphiline.

The bottom of the large iron floating fire engine at Portsmouth has been coated, in sections, with the compositions of four different makers, to test the comparative value of each in preserving and keeping clean the bottom of iron vessles. The names of the competing manufacturers are—M. Guibert, of Paris; Messrs. M'Crea, of Liverpool; the Dublin Steam Packet Company; and Mr. Hay, the Admiralty chemist, Portsmouth.

At the last meeting of the Royal Dublin Society a paper, by Messrs. Wonfor and Pontifex, students in the laboratory of the Museum of Irish Industry, was read "On the Quality of the Milk Sold in the Poor and other Districts of Dublin." The authors examined twenty different samples; thirteen of them were from poor, and seven from richer districts of the city. The examination proved that the only adulteration was water. Pure milk contains 87·3 per cent. of water; the average quantity in the thirteen samples from the poor districts was 90·28; the average quantity in the seven samples obtained in the better districts was 89·4.

Messrs. Morton and Co., engineers and contractors of James-street, Liverpool, are engaged in the construction of an immense graving dock (composed principally of iron) for the Messrs. Laird, of Birkenhead, and to be erected at the last-named place. The structure will be 300 feet in length, and 80 feet in width. It will be spanned by trussed girders, the whole of which are to be severely tested before being affixed in their places. The Messrs. Laird are adding this dock to their already extensive shipbuilding premises, in anticipation of large orders from the Government for the construction of iron-plated ships of war. Morton and Co. have in hand also five girder bridges of wrought-iron for the Great Western Railway, and to be erected at Birmingham.

Business is largely on the increase at the Branch Mint of Sydney, and if the Home Government still persist in refusing to allow the colonists of Victoria to have a mint of their own at Melbourne, why the Sydney mint must soon be increased in size. From the 1st of January to the 14th of February in the present year, there was imported into the Sydney mint for the purpose of coinage, 122,762 ounces of gold dust. This yielded 416,000 sovereigns. Last year, during the corresponding period, the importation of gold dust to the same place amounted to only 70,640 ounces, and the coinage of sovereigns to 208,000. This marvellous increase, which seems likely to be maintained, is owing partly to the new gold fields of New Zealand, and partly to larger supplies of the auriferous material from the fields of West and South Australia. The mint of Sydney, when originally constructed, had not productive mechanical power commensurate with the work to be done, and now it is altogether inadequate to its ends.

The following communication has been addressed to the Council of the Chamber of Commerce of Birmingham and the Midland districts:—"Office of Committee of Privy Council for Trade, Whitehall, April 9. Gentlemen,—I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your memorial, praying for an extension of the terms of copyright for ornamental designs applied to works in metal, and supporting your application by the statements of manufacturers personally engaged in the several departments in that branch of trade. From the evidence thus furnished it appears that the time occupied in preliminary arrangements, and the preparation of designs previous to the manufactured article being presented in the market, varies from six to twenty-four months. The majority of those by whom these statements are furnished ask that a period equivalent to the time thus consumed may be added to the existing term of protection, thus extending the whole to five years. My Lords direct me to acquaint you that, considering a case to have been shown for the expediency of the extension, instructions have been given to the officer at the head of the Registry of Designs, to take the necessary steps for extending the copyright of all articles in metal included in Class 1, from three years for the future.—I am, Gentlemen, your obedient servant, J. EMERSON TENNENT."

The suicide in Blackheath Tunnel has once more brought to the notice of the public the impropriety and wrongfulness of not lighting third-class carriages. Mr. Missing shot himself while in "utter darkness." No fellow passenger could have rendered any assistance. In fact, the slightest jerk of the suicide's hand might have sent the bullet through another man's head. It is a matter of wonder that third-class passengers should be so neglected. They are by far the largest class of society. Taken carriage for carriage, a third-class train pays better than a first-class train. How frequently first-class carriages are empty when third-class carriages are stuffed full. Still, first-class passengers receive unbounded attentions, while third-class passengers are treated something like "dumb driven cattle." The truth is, that the gangrene of flunkeyism has corrupted the whole framework of society. The remedy is in the people's hands. One of our correspondents thinks there should have been an Act of Parliament to compel railway directors to light up third-class carriages.

On Wednesday afternoon, last week, Mr. F. N. Gisbourne's patent electric target was tested at the butts of the South Middlesex Rifles, Beauford House, Walham-green, in the presence of a large number of gentlemen connected with the different rifle corps of the district. The firing commenced at 150 yards, and was continued at 200 yards with great accuracy, and the shots were correctly registered on the paper by the electrical machine of Mr. Gisbourne. The arrangement is simple, and from its simplicity arises its great accuracy and constant value. The target is six feet by two feet, divided into 17 compartments—viz., a bull's eye, four centres, three above the centre, three below the centre, three tops, and three bottoms. These are connected by separate wires to the machine, and each compartment being a separate plate, it registers itself in the machine at the shooting-stand. During the firing a circumstance occurred twice which seemed to impugn the accuracy of the apparatus, On one occasion it indicated wrong, but upon examination it appeared that the paper had been put into the machine the top side to the bottom, thus reversing the indication; but when it came to be compared with a paper properly inserted, it was found that the machine had done its duty accurately. On the other occasion the indication could not be found at all, but on turning the paper over it was discovered that the machine had indicated the shot on that side, thus showing that the paper had been put in upside down. It is needless to say that the indication was correct.

IRON-PLATED SHIPS OF WAR.—We are informed that a step of great importance in the existing state of our naval affairs has just been taken by the Board of Admiralty. It is well-known that at the present moment our entire fleet of small vessels of war is built of wood, and is wholly unprotected by armour plating. Every corvette, sloop, and gunboat in the service is liable, therefore, to sudden and complete destruction by the shell fire of an enemy. In view of these facts, a complete stop has recently been put to the construction of further vessels of this kind in the Royal dockyards. In France for some years past, and in America, during the last year, small iron-plated craft have been designed and built; but in all cases these have been fit to operate upon home coasts and harbours only, and have been wholly incapable of performing general sea service. Our own Admiralty and their constructors have naturally been averse to the building of similar vessels; but at the same time, no means of producing sea-going plated ships of moderate dimensions have been devised. At length, however, a method of construction has been devised, which is said to afford great security, with a comparatively small amount of plating, and which has met with the full approval of the Board. The new design has been made by Mr. E. J. Reed, formerly of the School of Naval Construction, Portsmouth, now secretary to the Institution of Naval Architects, under the general supervision of Admiral Robinson, the Controller of the Navy. It is applicable to ships of various classes, and provides for the use of a powerful plated battery of Armstrong guns, with a great range of fire; for the security of the ship from penetration between wind and water; for steaming power scarcely inferior to that of the present unprotected vessels; and for the protection of boilers, engines, rudder-head, and steering apparatus. These advantages are said to be secured without at all compromising the fitness of the ship to receive a complete rig and equipment, so that she may be fit for sea service in any part of the world. The design, we understand has been placed unreservedly at the disposal of the Admiralty, who have issued an order for its immediate adoption, and have appointed the inventor, Mr. Reed, to superintend the construction of the vessels in Her Majesty's dockyards. The timber now in store, and even that already converted, will be available for the new vessels, which are to be timber-built below the water, but incombustible at the upper part. Although the design was only completed a week ago, all the preliminary arrangements for carrying it out have already been made, under the immediate care of the Controller and the Duke of Somerset. The first vessel is to be commenced forthwith at Deptford dockyard, and is to be named the Enterprise.—*Times.*

A CONFEDERATE STEAM RAM.—The following description of Hollins's steam ram, which has been remodelled and rebuilt since the engagement at the mouth of the Mississippi, we take from the *St. Louis Republican*:—"I have seen a rough sketch of Hollins's celebrated gun-boat—the Manassas, or Turtle—taken from the descriptions of intelligent persons in Columbus who have seen her. She is about one hundred feet long, and twenty feet beam, and draws from nine to twelve feet water. Her shape above water is nearly that of half a sharply-pointed egg-shell, so that a shot will glance from her no matter where it strikes. Her back is formed of twelve-inch oak, covered with one and a half inch bar iron. She has two chimneys, so arranged as to slide down in time of action. The pilot-house is in the stern of the boat. She is worked by a powerful propeller, but cannot stem a strong current. She carries only one gun, a 68-pounder, right in her bow. The secessionists of Columbus say that at one time she would have come up here to test the metal of our forts, if the water had not been too low. There was no time, however, while she was at Columbus, when there was not water enough to float her. She is said to be now at Island No. 10, and it is reported that she would come up and engage our boats if she could stem the current. There are too many "ifs" about the institution. There is only one entrance to her, through a trap-door in her back. Her port-hole is furnished with a heavily-plated trap, which springs up when the gun is run out, and falls down when it is run back. How the crew get their light and air I can't pretend to say."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c. *None.*
BOILERS AND THEIR FURNACES, &c., 2499.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2471, 2476.
SHIPS AND BOATS, including their fittings, 2467, 2492.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2487.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, *None.*
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2475, 2483, 2486, 2490.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., *None.*
LIGHTING, HEATING, AND VENTILATING, 2473, 2491, 2495.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2466, 2470, 2479, 2481, 2485, 2488.
METALS, including apparatus for their manufacture, 2489.
CHEMISTRY AND PHOTOGRAPHY, 2477, 2482.
ELECTRICAL APPARATUS, 2464.
WARFARE, 2465, 2498.
LETTER-PRESS PRINTING, &c., *None.*
MISCELLANEOUS, 2468, 2469, 2472, 2474, 2478, 2480, 2484, 2493, 2494, 2496, 2497, 2.

2464. W. T. HENLEY. *Improvements in magnetic and electric telegraphic apparatus, which are also applicable to other purposes.* Dated Oct. 3, , 1861.

This invention has reference to two previous patents, dated respectively 22nd November, 1856, and 23rd March, 1861 (No. 734), and consists in dispensing with the crank wheel and pinion or cam wheel and roller, and simply having a wheel or two wheels fixed together, and turning on a central stud, each wheel or wheels having pieces of iron fixed on the periphery or near the edge, which pieces make connection between the permanent magnet and the detached armature, thereby conveying magnetism from one to the other, the movable pieces being rendered magnets by the permanent magnets in turn rendering magnetism in the stationary soft iron, the pieces on the wheel corresponding with the letters on the dial, there being half as many pieces on each wheel as there are letters, each piece on the upper wheel connecting the upper end of the temporary magnet alternately with each pole of the permanent magnet, each piece on the lower wheel doing the same with the lower half of the temporary magnet; in this way all complicated machinery is dispensed with; the wheel being caused to turn on the central stud without touching the magnet produces as many currents in one revolution as there are letters engraved on the dial, and causes the indicator to make one revolution on the latter. *Patent completed.*

2465. J. C. Haddan and C. Minasi. *Improvements in the mode of discharging cannon, and in apparatus for facilitating the proper aiming with fire-arms.* Dated Oct. 3, 1861.

This consists in the use of a rod passing through the vent of the vent-pieces of breech-loaders, which rod may carry on it a percussion cap, or other igniting contrivance, or which may be caused to strike on or against a cap or igniting contrivance placed on a nipple, the object being to prevent or lessen the injurious heating of the breech. The invention also consists in constructing the stocks of rifles with the butt hinged or jointed to the barrel-holding portion of the stock, whereby facility is afforded for sighting the object. *Patent abandoned.*

2466. T. Warwick. *An improvement in the manufacture of umbrellas and parasols, and improvements in machinery to be used in the manufacture of umbrellas and parasols.* (Partly a communication.) Dated Oct. 3, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2467. H. Law. *Improvements in machinery and apparatus for raising ships and other vessels out of the water for the purposes of examination, cleaning, or repair, some of which are applicable to the docking of vessels for the same purposes.* Dated Oct. 3, 1861.

The details of this invention are too voluminous to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2468. J. A. Tannahill. *An apparatus for counting money.* Dated Oct. 3, 1861.

Here the money is fed into a wide mouthed funnel, the pipe of which is large enough to allow the coins to fall flat one upon the other, to ensure which a conical-shaped piece of metal is to be fixed in the centre of the mouth by means of a metal rod; a small space is left between the bottom of the funnel pipe and a semicircular plate or ledge upon which the coin falls, from which it is withdrawn by a rotating disc so formed around its edge that it shall have numbered spur-like projections or teeth, the space between each being of such a curvature as to suit the size of the coin, and carry it around the plate until it reaches an opening formed therein, through which it falls into a drawer or other receptacle; a small plate of metal is fixed above the opening to prevent the accidental passage of the coin beyond the opening, and a hole is perforated in this plate for allowing the odd coins to be counted by the number on the disc, one revolution of which takes a sufficient number of coins to make one pound. *Patent abandoned.*

2469. R. J. Ellershaw. *An improved machine for expressing oil.* Dated Oct. 3, 1861.

Here the oil is expressed by an arrangement of rollers instead of by hydraulic pressure. *Patent abandoned.*

2470. T. Evans. *Improvements in the manufacture of boots, shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture.* Dated Oct. 3, 1861.

Here the inner sole and the upper leather are placed on the last in the ordinary way; the last is then put in the machine and rests upon a slide and upon a cross bar, by means of which the drafting or stitching is performed; the toe part of the last bears upon a cross bar capable of raising or lowering the last, so as to adjust it to the clip used in crimping or piping. The drafting or stretching is performed by temporarily fixing the toe part of the upper to the said cross bar, and by drawing back the said slide, carrying the last until the upper is sufficiently drawn, when the piping of the toe and heel may be performed by inserting a cord or wire round the edge of the upper at the toe and heel; these are then linked together and tightened, to retain the piping, and the waist is then drawn in by the action of the shoemaker's pincers ordinarily employed, and the upper is secured as usual to the inner sole by tacks, or by being braced in the usual manner; or the piping may be performed by clips centred on slides placed at each end of the last. In the arrangement hereafter described three clips are applied to the toe only; each slide is worked by a screw, and is fitted with a camb which causes the clips to act on the edge of the upper and perform the operation of piping. When the piping is fixed, the said clips and slides, which are connected together in a case or frame hung on centres, may be drawn back from the last. The outer sole is placed on the last ready pierced, and is blocked by means of straps, which are passed over the sole, and may be connected to hand or foot levers. The machine or apparatus may be attached to a counter or table, and any size of last can be used without altering the machine. *Patent completed.*

2471. C. Mauvernay. *An improved method of signalling the passage of trains upon railways.* Dated Oct. 3, 1861.

This invention consists in placing along the side of every line of railway, and at intervals between two points where attendants are situated, two vessels containing water, united by a pipe communicating with each vessel, so that the same water level is maintained in each. On varying the level by liquid being poured into or withdrawn from one vessel, the level will be altered in the other vessel, and thus the passage of trains may be signalled from attendant to attendant all along the line. The inventor provides each vessel with a tap for drawing off liquid as required. The signals may be variously made. For instance, when the standard or ordinary level is maintained, "All clear" may be indicated; when the level is below the ordinary point, "Stop the train," and, when the level is raised above the standard level, it may indicate "Danger." And, in fact, any required signals may be agreed upon. *Patent abandoned.*

2472. J. Wood. *Improvements in the manufacture of metal pens and holders, in tools employed therein, and in cards for carrying the same.* Dated Oct. 3, 1861.

The main object of this invention is to produce pens ready for hardening and tempering by machinery, and without waste of metal. The invention consists in cutting out from the back or tail end of one pen the point of another, and so on for as many pens as the strip of metal will make. The inventor forms cards for carrying pens by stamping, embossing, or otherwise raising portions of the surface thereof, leaving spaces between the raised surfaces for the reception of the pens and penholders, so that when the latter are laid and stitched on the card, they do not rise above the raised portions of the card. Or the pens may be stitched on the raised surfaces. He prefers to make the dies for producing the raised surfaces on the cards circular. *Patent abandoned.*

2473. W. Malam. *Improvements in gas holders, and in apparatus for testing gas holders, and in apparatus for testing gas meters, also in apparatus for the manufacture of gas.* Dated Oct. 3, 1861.

Here, instead of the usual mode heretofore adopted of feeding retorts by hand, the patentee employs a self-acting feeding apparatus. *Patent completed.*

2474. J. Stuart. *Improvements in the treatment of oils retained by distillation of bones and other animal matters for the purposes of obtaining matters which may be used as pigments and dye stuffs.* Dated Oct. 4, 1861.

This process is to treat common bone oil with hydrochloric acid, or a solution of sulphuric acid; then to separate the dirty acid, and treat it with alkalis, when a substance is deposited which forms a brown pigment. The oil is then placed in a retort, with certain proportions of oxide of iron, and carbonate of potash, and the whole is distilled over until perfectly dry, the product being refined bone oil, and the residuum left ferrocyanide of potash, and may be used as such or converted into Prussian blue. *Patent abandoned.*

2475. P. Knowles. *Improvements in machinery for opening and cleaning cotton and other fibrous materials.* Dated Oct. 4, 1861.

This consists, 1, in an improved arrangement of parts forming an opening machine to which lapping rollers are applied or act. 2. In an improved feeding apparatus for supplying cotton &c., to openers, blowers, scutchers, and such like machines. 3. In applying toothed rollers between the beaters or cylinders in those openers in which two or more beaters or cylinders are used. *Patent completed.*

2476. E. T. Hughes. *Improvements in the permanent way of railways.* Dated Oct. 4, 1861.

This consists in forming the chairs with a large bed plate having inclined edges on the outside to prevent the accumulation of water or sand; one of the cheeks of the chair is movable, and so formed that the rails rest upon it between the cheeks. The lower part of the cheek fits a groove in the bed plate, and is pressed up by a key or wedge, so as to force the movable cheek against the rail and hold it fast. Under the bed plate there are strong ribs for obtaining strength, and preventing the chain from shifting in the ground. Connected to each chair there is a bar extending across the link to hold the two opposite chairs firmly at the proper distance apart, and some of the chairs have long cheeks acting as splints to allow of the junction of the rails. *Patent completed.*

2477. C. Husson. *Improved process for silvering looking glass in piles of several sheets, superposed without interruption, which process consists in the use of a chemical powder.* Dated Oct. 4, 1861.

This consists in a great measure in the use of a chemical powder, without which the sheets of glass could not be separated. This chemical powder is composed of three matters in the following proportions:—White soap in powder about 12½ oz., starch (the residue of wheat) about 14 oz., the whole to be well pulverized, sifted, and quite dry. Plates silvered by this process may be lifted 3, 4, or 5 hours after the operation (according to the dryness or humidity of the atmosphere), to be placed to drain. *Patent completed.*

2478. A. David, Junior. *Improvements in preparing and fixing street and other inscriptions or lettering.* Dated Oct. 4, 1861.

Here the plates bearing the letters, &c., are, after the fusion of the metal, scoured with an acid, then washed and dried, coated with wax, and placed in a heated oven. The painting in drying oils is then laid on in two coats. *Patent completed.*

2479. J. Beesley. *Improvements in crinoline covering wire and other substances.* Dated Oct. 4, 1861.

This invention relates to covering crinoline wire, and other like substances, in looms ordinarily used in weaving ribbons and other like fabrics, for which purpose the inventor constructs a reed or slay to be used in such looms which permits the crinoline wire or other substance to pass horizontally through the slay, the dents of the slay, being intercepted, and their ends, where intercepted, lodged in bars crossing from side to side of the slay, through which bars the crinoline wire or other substance is passed in the process of covering. He then imparts an upward movement to the slay while the shuttle passes through the under shed. *Patent abandoned.*

2480. G. Knox. *An improvement in paper-making machines.* Dated Oct. 4, 1861.

The patentee states that a great desideratum hitherto in the manufacture of machine made writing and printing papers, is a readily cleansing knotter, whereby it shall be kept uniformly in the greatest practicable state of cleanness, and so cleansed that there shall be no stoppage of the machine, nor of any part of the knotter while supplying the machine with pulp, the bad effect of that being to pass through the knotter plate some of the knots and dirt that are being disturbed, and more especially to increase suddenly by the removal of the knots and imperfectly reduced pulp, the weight of the paper which previously had been gradually diminished by the accumulation of the same. To effect this he makes a circular knotter plate of brass or other metal, or he puts together a number of segmental plates, say eight, or any other number, so as to form a circular knotter plate, the cuts or slits being of the dimension and size commonly in use. He fixes the knotter plate in a bed or framework of convenient depth to admit of a continuous flow of pulp from the pulp chest being distributed over the part of the surface exposed thereto, and underneath which is placed a trough to receive the pulp and pass it on to the machine. By means of some convenient mechanical arrangement, he makes the knotter thus completed to rotate horizontally, and he communicates to the same, by appliances to the axis or shaft through the centre, the jumping motion, which is now generally given to knotters for the purpose of shaking the fibre through the knotter plate, and thereby supplying the wire of the machine. This trough for the supply of the machine (which he places at the end thereof and contiguous thereto), is the shape and size of one half of the circle by a line drawn through the centre, although it may be of other proportions, and he places another trough forming a like semicircle underneath the other portion of the knotter plate, the contents of this trough being conveyed by means of a pump to the beating engine. He also divides the upper surface of the knotter plate into two parts, one of which includes the entire semicircle or other proportion of the knotter plate placed above the trough for the supply of the machine, and one fourth or other proportion of the other semicircle (making ¾ of the entire circle), and this division he effects by means of a belt or cushion of vulcanized india-rubber, or other suitable material of the depth of the knotter bed fastened to a frame, so that the india-rubber by means of a spring applied to the frame, presses firmly against the knotter plate, and is kept in a slightly inclined position towards the same, and which frame has communicated to it the same jumping motion as the knotter. He applies to the ¼ or other proportion of the knotter plate, which is thus kept free from pulp, a constant stream or shower of water, with such a degree of force as will entirely cleanse the cuts of the knotter plate as they come under its operation by the circular motion of the knotter, and the part thus cleaned passes under the india-rubber belt, and is brought again as clean as a new knotter plate to receive fresh pulp. On the small section of the knotter plate, viz., ¼ or other portion which receives the pulp on the upper surface, but is always moving over the water trough and never over the machine trough, the knots will accumulate as the plate moves round, but they are kept back by the india-rubber belt, and as often as may be necessary are removed with an india-rubber scoop or other contrivance, care being taken not to approach too near the part over the machine trough so as to injure the quality, or disturb the weight of the paper. *Patent completed.*

2481. C. M. Elston. *Improvements in buckets and portable water cisterns.* Dated Oct. 4, 1861.

Here the patentee makes buckets and cisterns by weaving them round, in place of using fabrics made or woven in the usual way, and converting them into buckets or cisterns by seams or joints at one side of each bucket or cistern. *Patent abandoned.*

2482. T. G. Ghislin. *Improvements in the treatment or preparation of certain foreign plants or vegetable substances, and of the application of the same to various useful purposes, for which horn, shell, whalebone, indurated leather, fish skin, ivory, bone, hardwood, and compounds of india-rubber or gutta-percha, have hitherto been employed.* Dated Oct. 4, 1861.

These plants are known to botanists as eiklonia, boccinalis, laminaroe buccinalis, duvillea utilles, sarcophycus potatorum, and their allies. These plants, when treated according to the invention, are converted into a variety of useful articles. *Patent completed.*

2483. J. Pratt. *Improvements in shuttles for weaving ribbons.* Dated Oct. 4, 1861.

This consists in forming the shuttle for, and disposing the bobbin or spool containing the weft thread therein, in a position behind the grooves, instead of in front as heretofore, by which the inventor is enabled to introduce sufficient thread to weave half a piece of ribbon, and about twelve times the quantity now introduced. *Patent abandoned.*

2484. J. Dallagana. *Improvements in finishing and perfecting curved or circular stereotype plates, and in apparatus for the same.* Dated Oct. 4, 1861.

This relates to the stereotype plates used in printing machines, in which they are fixed on a cylinder, and form a cylindrical surface. In these plates it is very important that they should have a truly cylindrical form, or part thereof, and also that they be of uniform thickness, to produce which the inventor subjects curved stereotype plates to a planing and compressing process, planing them on a metal bed smoothly, and very truly prepared of the form desired, over which a curved instrument travels in a longitudinal direction, being forcibly impelled and rigidly confined by suitable guides in its course over the stereotype plate. The plate being held by suitable stops, the instrument in passing over the plate forces every part of its surface down on the curved bed, by which it receives its true form. The instrument at the same time shaves from the back part of the plate any excess of thickness, and reduces the whole to a uniform thickness. *Patent abandoned.*

2485. S. Icely. *An improved manufacture of gongs.* Dated Oct. 4, 1861.

This consists in forming gongs of steel hammered up to somewhat of the ordinary form of gongs, preferring to make them less angular around the disc parts. *Patent abandoned.*

2486. J. Tweedale. *Improvements in machinery for preparing and spinning cotton and other fibrous substances.* Dated Oct. 4, 1861.

This consists, 1, in balancing the combs that doff the doffers of carding engines by having the centre of gravity of the shaft or bar (to which the arms that carry the centre are fastened) on the opposite side of the centre of motion to that on which the combs are, or balancing the combs, when they are screwed or riveted to the arms or plates by a rod or bar fastened on the opposite side of the shaft to that on which the combs are. Also in having the connecting rod that connects the comb with the stud or

Digitized by Google

eccentric that produces the arbratory motion, horizontal, or at an angle less than 45 degrees to the horizon. Also in driving the combs by wheels or friction pulleys. *Patent completed.*

2487. J. Lansley. *Improvements in the construction of ploughs, drills, scarifiers, and such like agricultural implements, said improvements relating to the mode of guiding or steering the same.* Dated Oct. 5, 1861.

This consists more particularly in certain peculiar arrangements of mechanism adopted for guiding and steering the implements, and also in the peculiar arrangements adopted for the purpose of setting and adjusting those parts of the same which regulate the depth of the work done, and the position of the line of draft for the horses. We cannot quote the details of the invention. *Patent completed.*

2488. J. Edwards. *Improvements in the manufacture of buttons.* Dated Oct. 5, 1861.

This relates to the application of brass, copper, or zinc coated with German silver in any way to the manufacture of buttons or parts of buttons; also to the application of a metal face to bone buttons, when such buttons are made with a projecting shank for the button-hole to work on. *Patent completed.*

2489. E. Paotaidox. *Improvements in hardening iron and steel, and composition or substance to be employed therein.* Dated Oct. 5, 1861.

This invention consists in first heating the article to be hardened in a bath of lead or other suitable molten metal, or in a retort or vessel, so as to be protected from the direct action of fire; in applying to it, either in the bath or retort, or immediately on its withdrawal therefrom, the following composition or substance, either in a state of powder or in a liquid state, and in some cases, in returning the article to the bath or retort after such application. The invention also consists in preparing the composition or substance for hardening iron and steel with the materials and in manner following. The inventor takes prussiate of potash, or other substance containing cyanogen, or possessing like chemical properties, and reduces it to powder; he mixes with it powdered nitre and common salt, and fires or sets fire to the composition. He takes the resulting ashes or substance remaining after the firing, and powders it. This powder liquifies under heat, and he uses it alone or mixed with charcoal, animal, or vegetable, or other suitable form of carbon, or he liquifies the powder by dissolving it in liquid or ammonia, or other suitable solvent, and applies it to the articles to be hardened in a liquid state. *Patent abandoned.*

2490. W. Rowan. *Improvements in cylinders or drums and beaters for machines for scutching and preparing flax and other fibres.* Dated Oct. 5, 1861.

Hitherto the cylinders or drums employed in the scutching and preparing of flax and other fibres have been rigid, and, consequently, the combs, beaters, pins, or teeth fixed thereto or thereon, have been rigid also, and have therefore acted more or less injuriously on the fibres. Now by this present invention this defect is remedied, and the invention consists in forming the cylinders or drums in segments, and in making one end of each segment fast to the frames, while play is allowed to the other end limited by stop pins or otherwise; the free ends of the segments or those to which the play is allowed, carry the combs and beaters or other tools or apparatuses intended to act upon the fibres. The rapid rotary motion imparted to the drum causes the combs, beaters, or other apparatuses to be thrown by centrifugal force with a spring-like action into and amongst the fibres. *Patent completed.*

2491. P. O'Connor. *Improvements in the construction of gas stoves for heating and warming.* Dated Oct. 5, 1861.

Here the stove or apparatus is almost entirely immersed in the water, and the gas is conveyed thereinto by a flexible or jointed tube, so that as soon as the desired temperature has been obtained, the said stove or apparatus can be removed from the water. The principal part consists of a U, serpentine, coiled, or other suitably shaped metallic casing, exposing a large surface to the water for effective distribution of the heat. The gas from the tube above referred to, is burned at jets fixed in a T or other bracket, by preference under a part of the apparatus formed into an arch, and combustion is maintained by a supply of air received at one end of the apparatus, the products being carried through the apparatus to the other end, whereby a small intercepting inverted cup, situated just over the surface they are thrown on to and absorbed by the water, being heated, thus preventing the escape of noxious effluvia into the atmosphere. *Patent abandoned.*

2492. J. S. Collins. *Improvements in reefing and furling the sails of ships and other vessels.* Dated Oct. 5, 1861.

This consists in a method of furling, reefing, unfurling, or unreefing sails, by winding the foot of the sail upon, or unwinding it off a chain (parcelled to give it stiffness), a rod, or other suitable substitute. This is effected by placing on or near the ends of the lower yard, boom, &c., framing to carry chain wheels moveable on an axis, by which means the lower boom or yard is made to wind or unwind the sail, as required. The chains for working the said wheels are led in the most convenient manner to the deck, and, as they may be worked simultaneously with the halyards, the same amount of sail may be taken up on the yard or boom, as is given down by slacking the halyards, and thus an equal strain is always kept upon the sail. *Patent completed.*

2493. J. Turner. *An improved machine for mixing, mincing, and pounding.* Dated Oct. 5, 1861.

Here the inventor uses a mixing receptacle to contain the articles to be operated upon; it is supported on a central pivot, and is free to revolve thereon. Motion is communicated to the receptacle by a handle placed on a horizontal shaft, carrying an endless screw gearing into a circular rack on the outside of the said receptacle. Pulleys are keyed on each end of the horizontal shaft, and conveys the motion by bands to fly-wheels placed on each side of the machine, and connecting-rods attached to each of the fly-wheels communicate motion to a cross-head working over the said receptacle. To the crosshead is attached the mixing or other instrument required for use in the different purposes to which the machine is applied for mixing purposes; a pair of whisks are used, the prongs of which pass between each other as the whisks revolve within the said receptacle. *Patent abandoned.*

2494. G. Nares. *Improvements in apparatus for effecting communication between places otherwise inaccessible to each other.* Dated Oct. 5, 1861.

This consists in effecting communication between places otherwise inaccessible to each other, by means of a kite. *Patent completed.*

2495. W. Clark. *An improved gas regulator and purifier, denominated the "French Purifier."* (A communication.) Dated Oct. 5, 1861.

Here a plug or mass of felt, wadding, or flock, is placed in an enlargement or chamber made in the base of the burner, through which the gas passes, and is thereby purified, and burns under a constant and steady pressure. *Patent abandoned.*

2496. T. Hughes. *An improved high pressure tap for regulating and controlling the flow of steam, water, or other fluids, which tap the inventor purposed designating as "Hughes' Equilibrium Pressure Tap."* Dated Oct. 5, 1861.

These improvements in taps, whether used for regulating the flow or the drawing off of fluids, are applicable for general use, but more particularly for high pressure purposes, whether for steam water or other fluids, and the invention consists in making the plug taper and hollow, so as to permit the fluid, under all circumstances, to enter the interior of the plug, and by its force being exerted in all directions equally the plug will not be liable to be tightened by the pressure of the fluid, or to work loose. The patentee effects this object by forming a number of radial holes or apertures around the top or enlarged part of the plug opposite the flow way in the plug, and at the lower or small end of the plug he forms one hole or flow-way, which being turned opposite the nose or front flow-way of the tap permits the fluid to escape, or to be drawn off, or to flow through as required. The plug may be retained in the body or barrel of the tap by a washer and screw at its smaller or lower end, or by a collar, surrounding the neck of the plug at the top, screwed or otherwise secured to the body of the tap, or otherwise as may be preferred, according to the purpose, or shape, or design, in which such taps or cocks may be required to be made. *Patent completed.*

2497. W. Squire. *Improved machinery for planing and shaping wood.* Dated Oct. 5, 1861.

Here the patentee planes the opposite faces of planks, &c., simultaneously, and thereby ensures perfect parallelism, by the use of a combination of machinery, wherein a pair of cutters, rotating in vertical planes, and capable of receiving a nice adjustment, operates simultaneously upon opposite sides of the work, which work is fixed in and carried forward between the rotating cutters by means of a travelling carriage. This carriage is so constructed as to hold securely either a single plank or block, and present the vertical sides to the cutters, or a pile of planks may be so packed therein as to present their edges to the cutters. By a slight modification, the machinery may be made to plane inclined faces, or by a change of cutters the machine may be adapted to cut mouldings. *Patent completed.*

2498. B. P. Walker. *Improvements in rifle sights and rifle-sight guards, and a new or improved rifle cleaner.* Dated Oct. 7, 1861.

Here the inventor cuts away that part of the sight situated under the V-shaped or other notch, through which the aim is taken, by which construction the object aimed at is seen underneath the notch. This part of the invention is applicable to all kinds of rifle sights. The invention also consists of a rifle-sight guard, made of a strip of tempered steel, which is bent into a tubular form, one end of the said strip being made into an arch. The tubular part springs on the end of the rifle barrel, and the arch part covers the fixed sight. By means of a slight projecting tongue cut in the tubular part, and near the arch part, the tubular part can be readily sprung open so far as to permit of its ready removal from the barrel. The invention also consists of a rifle cleaner, resembling the ordinary rifle cleaner, excepting that, at its acting part, it carries a piece of tubular vulcanized india-rubber held by its middle. The free ends of the said india-rubber expand during use, similar to the cupped leather of a pump bucket expands, and the cleaning of the rifle is thereby more effectual than heretofore. *Patent abandoned.*

2499. A. Chaplin. *Improved combined winding engine boiler, and cooking and distilling apparatus, including improvements also applicable separately.* Dated Oct. 7, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2500. W. Callcott. *Improved means and apparatus for producing scenic effects.* Dated Oct. 7, 1861.

Here the patentee claims the production of scenic effects by means of a combination or combinations of glass, painted or distempered, prepared and framed, or supported in position with rollers or cylinders (constructed and faced in any required form, or of any substance), such rollers being supported and worked behind the glass so painted, distempered, and prepared, the whole essentially as described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Dec. 7, 1861.

3063. G. Clark, 30 Craven-street, Strand. Improvements in the use, application, and manufacture of iron or steel as armour for ships or batteries.

Dated Dec. 17, 1861.

3163. J. Dale, Manchester, manufacturing chemist. Improvements in the manufacture of glue or size.

Dated Jan. 1, 1862.

17. J. J. Gutknecht, Neuhof, near Fizers, Switzerland, engineer. Improvements in in meters for measuring gas, water, and other fluids.

Dated Jan. 16, 1862.

118. J. A. Knight, 4 Symonds-inn, Chancery-lane. Improvements in machinery for dressing mill-stones by means of a diamond cutter. (A communication.)

Dated Jan. 29, 1862.

238. B. Foster, Denholme, York, manufacturer, and J. Moore, manager. Improvements in machinery or apparatus for spinning and doubling wool and other fibrous materials.

Dated Feb. 26, 1862.

521. J. Dothée, Paris, gentleman. Improvements in the colouring or dyeing of horse-hair tresses, hats, or ornaments.

Dated March 6, 1862.

605. G. Lawrence, Newton-terrace, Westbourne-grove. Improvements in the manufacture of flesh gloves and flesh straps.

Dated March 10, 1862.

639. C. Massi, 13 Greville-street, Holborn, philosophical apparatus manufacturer. Improvements in means and apparatus for retarding and stopping carriages used on railways or common roads.

Dated March 12, 1862.

666. J. Fawcett, New Swindon, Wilts, smith. Certain improvements in the manufacture of cranks and crank axles for locomotive and other engines.

673. A. P. Gondolo, 29 Boulevart, St. Martin, Paris, merchant. A new or improved baking oven.

Dated March 13, 1861.

681. F. H. Fontaine, 15 Passage des Petites Ecuries, Paris. A process for reproducing photographics, drawings, paintings, and engravings engraved on metal.

Dated March 17, 1862.

742. W. Gossage, Widnes, Lancaster, chemist. Improvements in the manufacture of soda and potash.

Dated March 18, 1862.

754. A. A. Beaumont and J. A. Escalier, 2 Rue Ste, Appoline, Paris. A new kind of flying top.

Dated March 20, 1862.

789. W. Clark, 53 Chancery-lane. Improvements in the manufacture of soap. (A communication.)

Dated March 24, 1862.

811. J. Topham, Nottingham, machinist. Improvements in apparatus used for cleansing out the scum and removing the sediment from the water in steam boilers, and preventing incrustation therein.

817. J. Stewart, Glasgow, Lanark, plumber. Improvements in the manufacture of cards for Jacquard weaving. (A communication.)

Dated March 27, 1862.

841. W. L. Winans, Brighton, civil engineer. A new or improved mode of mounting, and apparatus for manœuvring ordnance in land fortifications.

851. E. H. C. Monckton, Thurloe-place, South Kensington. Improvements in the manufacture of effervescing liquids.

853. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in machinery, for preparing, combing, and dressing vegetable fibres. (A communication.)

855. J. Easterbrook and J. H. Alcard, Sheffield, manufacturers. Improvements in vices.

857. S. A. Emery, Arundel-street, Westminster, comedian. Improvements in the manufacture of soap.

859. W. F. Smith, and A. Coventry, Gresley Iron Works, Salford, engineers. Improvements in and applicable to lathes and machines for turning and cutting screws.

Dated March 28, 1862.

861. G. Alcroft, Church-row, Camberwell. Improvements in pressure and vacuum gauges.

863. W. A. Ashe, Bolton-place, Middlesex, gentleman. An improved mode of and apparatus for driving the propelling shafts of ships or vessels. (A communication.)

864. W. B. Nation, analytical chemist, Battersea. Improvements in manufacturing boxes or cases, and in the machinery or apparatus employed therein.

865. R. A. Owen, Manchester, engineer. Improvements in feathering and varying the pitch of screw propellers for steam ships.

866. E. T. Noualhier, Paris, manufacturer. An improved ventilator.

867. A. Lucetti, Glasgow, confectioner. Improvements in apparatus for expressing the juice from pulpy fruit.

869. R. Smith of Hamburgh, gas meter manufacturer. Improvements in wet gas meters.

Dated March 29, 1862.

871. R. Kay, Castleton Print Works, Lancaster, calico printer. Certain improvements in printing calicoes and other surfaces, and in apparatus connected therewith.

873. Y. Parfrey, Upper Belgrave-place, Pimlico, engineer. Improvements in breech-loading fire-arms.

875. I. Morris, Essington, near Wolverhampton. A new or improved machine for breaking up or cultivating land.

876. C. H. Townsend, J. Young, and J. Hankins, Bristol. An improved method of removing and preventing incrustation in steam boilers.

879. T. Cole, Coventry, licensed victualler. Improvements in the manufacture of figured ribbons and other textile fabrics.

881. R. Smith, Shaw-house, Melksham, Wilts, gentleman. Improvements in roller blind apparatus.

883. E. B. Holt, New York. Improved machinery for cutting cork, so as to render the same suitable for stuffing purposes. (A communication.)

885. W. E. Newton, Chancery-lane, civil engineer. An improved mode of applying acoustic apparatus in churches and other buildings and apartments. (A communication.)

Dated March 31, 1862.

889. R. Young, Glasgow, engineer. Improvements in apparatus for cleaning, separating, washing and drying grain.

890. N. Frankenstein, 12 Clarendon-villas, Mildmay-park, Middlesex. Improvements in machinery for cutting pointed, conical, and cylindrical corks. (A communication.)

891. W. Tyler, Birmingham, corn dealer. A new or improved mixture or composition for feeding dogs and other animals, and poultry.

895. W. B. Lord, Plymouth, veterinary surgeon, and F. H. Gilbart, Brixton, gentleman. Improvements in loading fire-arms.

897. R. C. Ransome, Ipswich. Improvements in thrashing and other machinery where corn or grain is required to be raised from one level to another.

903. H. Pooley, jun., Liverpool, engineer. Improvements in the construction of weighing machines and weigh bridges.

Dated April 1, 1862.

905. J. T. G. Stone, St. John's-road Hoxton, manufacturer. An improved bustle and petticoat.

906. P. R. Couchoud, 71 Rue de Rambuteau, Paris, lace manufacturer. A new or improved loom for manufacturing cheoille and other lace-work.

907. C. P. Gontard, Besancon, France, watch-maker. An improved stopping piece for watches and other time keepers, intended to limit the winding up of the moving spring.

913. H. Smith, Teesdale Iron-works, Stockton-on-Tees. Improvements in apparatus used when casting iron or other metal.

915. H. W. Caslon and G. Fagg, Chiswell-street, Middlesex, typefounders. Improvements in casting printing types, and in apparatus for rubbing the same.

917. E. Hartley, Oldham, Lancaster, machinist, G. Little, machinist, and J. Hinchcliffe. Improvements in rolling or straightening metal spindles, shafts, or rods of a cylindrical or tapered form.

919. H. J. Madge, Swansea, Glamorgan, tin plate manufacturer. Improvements in coating iron sheets or plates, to be used as a substitute for tin or terne plates.

Dated April 2, 1862.

925. S. Warren, Ledbury, Hereford, engineer. Improvements in machinery for transmitting motion obtained by animal power to agricultural and other machines.

927. W. Malam, Skinner-street, London, gas engineer. An improvement in the manufacture of gas, and improved apparatus to be employed in such manufacture.

929. G. Collier and J. Collier, Halifax, machinist. Improvements in looms for weaving carpets and other pile fabrics.

931. S. Hunter, 22 Grey-street, Newcastle-upon-tyne. Improvements in anchors.

933. J. T. Loft, Brooklyn, New York, architect. Improved machinery for printing in colours.

Dated April 4, 1862.

952. J. C. Kay, Bury, Lancaster, and W. Hortley, engineers. Certain improvements in steam engines.

958. H. Fletcher, Cornwall-crescent, Camden-road, Middlesex. Improvements in valves for hydraulic presses, and in apparatus connected therewith for making or pressing blocks or bricks of coal, or other material.

960. A. Woodhouse, Hindpool, Barrow-in-Furness, Lancaster, brick manufacturer, and T. Hunter, Hindpool, brick manufacturer. Improvements in the arrangements of kilns and flues for burning bricks, tiles, quarries, and other like articles, and in utilizing the waste heat of the said kilns, and in stoves for drying bricks, tiles, quarries, and other like articles.

964. R. A. Brooman, 166 Fleet-street, patent agent. An improved case for holding balls and reels of cotton, silk, and other threads. (A communication.)

968. W. E. Newton, Chancery-lane, Middlesex, civil engineer. An improvement in projectiles for ordnance. (A communication.)

Dated April 5, 1862.

970. J. D. Humphreys, 11 Aldhous-terrace, Barnsbury, Middlesex, engineer. Improvements in furnaces and machinery employed in the manufacture of compressed fuel and other matters.

972. W. Begg, Marsh-lane Foundry, Preston, ironfounder. Improvements in consuming smoke, and in furnace bars and bridges for effecting the same.

974. J. Colling, Seaham, Durham, ship owner. Improvements in apparatus for reefing ships' sails.

978. T. Critchlow, Bolton-le-Moors, Lancaster, engineer. Improvements in planing machines.

Dated April 7, 1862.

980. C. S. Duncan, Bayswater, Middlesex. An improved method of and apparatus for ventilating, cooling, or suppressing fire in public and private buildings or rooms.

982. W. Simons, Renfrew, North Britain, shipbuilder. Improvements in constructing ships or vessels.

984. E. Walch, Stratford-on-Avon, Warwick, gentleman. Improvements in register stoves and fire-grates, and in ovens and kitchen ranges.

Dated April 8, 1862.

990. W. Stephen, Glasgow, brickmaker. Improvements in apparatus for moulding or shaping clay for bricks or other like articles.

992. W. Beardmore, Glasgow, engineer. Improvements in steam rams for naval purposes.

994. J. Whitehouse, Birmingham, manufacturer. Improvements in the manufacture of metallic door and other knobs, and the ornaments of the pillars of metallic bedsteads, and other articles of like manufacture, and in attaching metallic mounts to china or earthenware knobs and ornaments, and roses for knobs.

996. C. P. Carter, Kennington Hall, Kent. An instrument for inserting photographic or other pictures into, or removing them from, between the "mounts" of photographic albums or other flat spaces into which the fingers cannot be inserted.

998. E. H. C. Monckton, 5 Thurloe-place, South Kensington. Improvements in timekeepers.

1000. B. Sharpe, Hanwell-park, Middlesex. Improvements in harrows and rakes.

1003. E. B. Sampson, Ham Mills, Stroud, Gloucester. Improvements in apparatus for supplying oil or other liquid to wool, as the same is fed into carding engines.

1004. J. Wright, Bridge-street, Blackfriars, civil engineer. Improvements in joining together armour and other thick metal plates, beams, and girders.

Dated April 9, 1862.

1006. S. Rodgett, Blackburn, Lancaster, foreman. Certain improvements in power looms for weaving.

1008. S. Farron, Ashton-under-Lyne, watchmaker. Improvements in machinery or apparatus for regulating the supply of steam from the boiler to the cylinder or pipes of steam engines, which improvements are also applicable to gases or fluids.

1012. W. Davies, Llanelly, Carmarthenshire. Improvements in puddling, balling, and re-heating furnaces.

1014. J. Langston, North-street, Strood. Improvements in the manufacture of Portland cement.

1016. J. Knowelden, Southwark, engineer. Improvements in steam, water, and other fluid engines.

1018. W. Mays, Joseph-street, Back-road, Shadwell, Middlesex, miller. Improvements in machinery for grinding corn, grain, and other substances.

Dated April 10, 1862.

1022. W. Armitage, Manchester, manufacturer. Improvements in looms for weaving.

1024. J. Houghton, Foster-lane, Cheapside. An improved haversack.

1028. G. D. Mertens, Royal-crescent, Margate, Kent, gentleman. Improvements in the preparation of materials to be employed in the making of beer, and in the machinery or apparatus employed therein. (A communication.)

1030. H. Deacon, Appleton-house, Appleton, Lancaster, alkali manufacturer. Improvements in the manufacture of caustic soda.

1032. J. Petrie, jun., Rochdale, ironmonger. Improvements in machinery or apparatus for blowing and exhausting air.

1034. C. Bartholomew, Broxholme, Wheatley, civil engineer, and J. Heptinstall, Masbrough, near Rotherham, York. Improvements in making circular blooms, such as are used in the manufacture of tyres, and for other purposes.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1065. F. Tolhausen, civil engineer, 17 Rue du Faubourg Montmartre, Paris. A telegraphic dial printing apparatus. (A communication.) Dated April 14, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

3068. G. Clark. Armour for ships or batteries.
3110. J. Leeming. Looms.
3111. R. Searle. Metals for sheathing ships, &c.
3113. W. Lightfoot. Bridle.
3119. J. W. Scott. Wads for fire-arms.
3123. S. B. Hewett. Boilers.
3126. H. J. Olding. Steam boilers.
3131. T. B. Gibson. Ornamenting certain fabrics.
3133. P. Quantin. Sleepers.
3136. J. Hetherington, T. Webb, and J. Craig. Spinning and doubling cotton.
3140. R. A. Brooman. Motive power engines. (A communication.)
3141. R. A. Brooman. Superheating steam. (A communication.)
3151. J. Willis, jun. Paper.
3152. G. P. Vallas. Portable baths.
3156. J. Aitken. Water to water wheels.
3157. W. G. Laws. Railway signals.
3167. S. Sheppard. Top.
3178. J. Bannehr. Desiccating grain.
3180. W. Betts. Cigars.
3185. A. Treullie and F. X. Traxler. Paper. (A communication.)
3203. D. C. Le Souef. Cylinders. (A communication.)
3205. T. Morris, R. Weare, and E. H. C. Monckton. Submarine communication.
3206. W. Bennetts. Gunpowder.
3214. J. H. Johnson. Cleaning grain. (A communication.)
3267. W. Spence. Lamps. (A communication.)
3274. E. T. Hughes. Saddles. (A communication.)
4. T. Ifall. Removing weeds from canals.
17. J. Jacob. Meters.
70. A. R. L. M. de Normandy. Fixing tubes.
158. A. J. Martin. Treatment of fusel oil.
742. W. Gossage. Soda and potash.
794. T. Marsh. Hames for horses.
869. E. Smith. Meters.
903. H. Pooley. Weighing machines.
933. J. T. Loft. Printing in colours.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated April 16, 1862.

2579. J. Lister and D. Myers.
2795. J. R. Wigham.
2583. W. T. Weston.
2585. R. Smith and J. B. Rowcliffe.
2590. R. Aytoun.
2594. J. Goucher.
2595. E. Peyton.
2601. P. Robertson.
2611. T. Fearnley.
2620. H. Lamplough.
2621. C. McDougall.
2628. F. Fenton.
2639. H. May.
2640. H. B. Fox.
2642. G. Archer.
2646. C. Brison and A. Chavanne.
2674. E. Alexandre.
2678. H. Gilson.
2683. M. A. F. Mennons.
2685. J. Sidebottom.
2727. J. L. Norton.
2733. G. Norman.
2771. J. Ashley.
2821. E. Loysel.
2912. J. H. Johnson.
2959. J. H. Johnson.
2965. A. W. Willis.
3033. W. Duchemin.
223. G. H. Morgan and E. Morgan.
226. W. E. Newton.
231. F. D. de Boutteville.
233. J. McKean.
354. W. Macnab.

Dated April 22, 1862.

2656. I. L. Pulvermacher.
2657. W. B. Lord.
2660. A. F. Campbell.
2661. T. M. R. Weare and E. H. C. Monckton.
2663. W. Dicks.
2666. R. A. Boyd.
2668. W. Wharton.
2671. E. Green and E. Green.
2694. W. Smith.
2675. T. Moore.
2698. W. Ryder and T. Ryder.
2710. R. Gibbon.
2736. L. Thomas.
2749. M. Henry.
2760. T. Lockie.
2762. S. W. Worssam.
2808. J. H. Johnson.
2914. F. Johnson.
3012. R. C. Perry.
162. W. Tozer and A. Read.
196. J. H. Johnson.
381. A. C. Ebbutt.
390. W. Tongue.
396. W. Tongue.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

924. W. A. Martin and J. Purdie.
943. A. McDougall.
949. G. Ashcroft.
972. J. Seaman.
977. J. Freer.
1002. J. Napier.
1008. E. Clark.
1010. T. S. Truss.
1033. T. A. Weston.
1037. E. Humphreys.
1046. R. Main.
1060. J. Holroyd.
1031. G. Ward.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

880. H. Mace.
886. R. Bright.
903. J. Whitworth.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending April 19, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
2245	1	4	2249	1	1	2253	0	3	2258	0	7	2262	0	5	2266	0	1
2246	3	2	2250	0	3	2254	0	6	2259	0	3	2263	0	3	...	...	
2247	0	3	2251	1	4	2256	0	3	2260	0	6	2264	0	7	...	...	
2248	1	11	2252	0	3	2257	1	1	2261	0	10	2265	0	9	...	...	

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, April 24, 1862.

		£	s.	d.		£	s.	d.	
IRON:									
Rails in Wales and North of England	pr. ton	6	0	0	to	6	5	0	nett
Welsh Bars, in Wales	„	6	5	0	„	6	7	6	—
Staf. Bars, at the Works	„	6	10	0	„	7	5	0	—
„ Hoops	„	7	10	0	„	8	0	0	—
„ Sheets, Singles	„	8	0	0	„	9	0	0	—
„ Nail Rods	„	6	15	0	„	0	10	0	—
„ Boiler Plates	„	8	0	0	„	8	10	0	—
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	11	3	„	0	0	0	nett
Do. No. 1, Good Brands	„	2	11	0	„	2	15	0	—
Scotch Bars	„	7	5	0	„	7	15	0	—
Swedish Bars, in London	„	10	10	0	„	11	0	0	—
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	3
Tough Cake and Tile	pr. ton	93	0	0	„	0	0	0	—
Best Selected	„	101	0	0	„	0	0	0	—
Australian	„	99	0	0	„	0	0	0	—
South American	„	0	0	0	„	0	00	0	—
Yellow Metal Sheathing	per lb.	0	0	9¼	„	0	0	0	2½
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	2½
„ Faggot	„	16	0	0	„	0	0	0	—
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	2½
„ Bar	„	6	2	0	„	0	0	0	—
Foreign, Banca	„	6	4	0	„	0	0	0	net
„ Straits	„	6	7	0	„	0	0	0	—
TINPLATES:									
Charcoal, I.C.	pr. box	1	4	0	„	1	7	0	3
Coke, I.C.	„	1	2	6	„	0	0	0	—
LEAD:									
Pig, English	pr. ton	19	15	0	„	21	0	0	2½
„ Spanish	„	19	0	0	„	19	10	0	—
Common Sheet	„	21	10	0		22	0	0	—
Tea „ [Wimshurst's Patent] A special disct.	„	35	0	0	,	0	0	0	—
SPELTER:									
On the spot	„	18	10	0	„	0	0	0	nett
For arrival	„	18	5	0	„	18	7	6	—
ZINC:									
English Sheet	„	24	0	0	„	0	0	0	1
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	3

JAMES LAURIE, Metal Broker.
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 2, 1862.

THE OPENING OF THE INTERNATIONAL EXHIBITION.

> "Sure there is need of social intercourse,
> Benevolence, and peace, and mutual aid
> Between the nations."

So sang, ninety years ago, the poet Cowper, and his words are full of truth and pregnant with meaning. Without "social intercourse" the nations of the earth would indeed degenerate into barbarism, and the fairest lands become the scenes of rapine and of bloodshed; social intercourse, and the other blessings which follow in its train, are the barriers which nature and Christianity interpose between civilization and savageism, and it is therefore the interest of humanity to uphold those barriers, and to lose no opportunity for strengthening them.

We regard the International Exhibition as one of the most effective agents for the promotion of harmony between the peoples of the world that can possibly be devised. The invitations which have gone forth far and wide for the transmission thereto of products, and manufactures, of works of art, and of the various specialities for which each country is celebrated, are as so many doves bearing olive branches, and they must be productive of peaceful and happy results. In the friendly rivalry which has filled the International Exhibition building with so rich a collection of natural and artificial productions that the world has never before witnessed the like, we see the dawning of a brighter era for the human race. And although it is true that, mingled with the beautiful and useful works of nature and of art, which are crowded together in rich profusion in the world's great show-room—although mingled with these are to be found warlike implements and death-dealing weapons, we do not despair of that time coming, when:—

> "Our armours may rust, our idle scimitars
> Hang by our sides for ornament, not use;
> Children shall beat our atabals and drums;
> And all the noisy trades of war no more
> Shall wake the peaceful morn."

That day may be distant, and the unhappy contest which now rages with ruthless violence among our own kindred—for such they are—on the great American continent, seems to say that it shall not yet dawn upon us—but it assuredly will come, and the International Exhibition is its harbinger.

The 1st of May, 1862, will henceforth be marked on the calendar as an important epoch in the annals of England, and the ceremonial by which the Exhibition was yesterday inaugurated was worthy of the great occasion. It is seldom indeed, that in the columns of this magazine other matters are treated of than those bearing directly or indirectly on mechanical science. It will be forgiven us, however, at such a season as this—when a vast conservatory, as it may be termed, for the reception of the flowers and the fruits of the world's industry, has been opened up for the inspection of the world's inhabitants—if we now wander somewhat from the beaten track, and venture into "fresh fields and pastures new." The Poet Laureate was never engaged on a more noble task than in composing that ode which was yesterday rendered so admirably under the roof of the new Palace at Kensington, and there were few present who did not find their hearts beating in unison with the sentiment conveyed in its opening lines:—

> "Uplift a thousand voices, full and sweet,
> In this wide hall, with earth's inventions stored,
> And praise th' invisible, universal Lord,
> Who lets once more in peace the nations meet,
> Where Science, Art, and Labour have outpoured
> Their myriad horns of plenty at our feet."

We felt it our painful duty, on a former occasion, to find fault with the construction of the building, in which are now to be seen the treasures of science, of art, and of labour, referred to by the Laureate; and although we have no wish to introduce a note of discord into his hymn of praise, we cannot avoid saying that our previous censure was fully justified. The building is *not* worthy of its purpose, and the involuntary comparisons instituted by all who visit it, and who saw the Crystal Palace of 1851, result unfavourably for Captain Fowke. It is unfortunate for the exhibitors and for the public that this should be so, because many of the objects shewn are seen to disadvantage, and the *tout ensemble* is far less striking than it might have been. It is useless, however, to repine over what cannot now be remedied, and all that remains for us is to be thankful that the building is not worse than it is—if that were possible.

It will scarcely be expected of us as yet to attempt anything like a critical analysis of the multifarious contents of the edifice. That will have to be accomplished in detail hereafter; but it is impossible for us to pass on without reverting to the machinery department, in which the majority of our readers take especial interest. If ever any section of the industrial trades of Great Britain had reason to be proud of their labours, assuredly it is that which has contributed to the filling of the British end of the Western Annexe of the International Exhibition. Some weeks since, a sketch was given of the contents of the Western Annexe, but marvellous and manifold have been the additions since made to them. As if by magic, gigantic engines, marine, locomotive, and stationary, have been placed under that fragile roof, which a puff of high-pressure steam would blow away, so flimsily is it built, and Maudslay, Rennie, Penn, Humphreys, and others, figure grandly in the show. Indeed it would almost appear that the engineers and machinists of the United Kingdom had joined in one common partnership, and opened up an immense erecting shop, in which their peculiar and best works should be exhibited. Those who visit the machinery department, be they from what clime they may, cannot fail to yield to the mechanics of Great Britain the palm of superiority. However this country may fare in the realms of art, or in the world of fancy, assuredly in the domain of mechanical science she stands in the Exhibition pre-eminent and unapproachable.

In saying this, we would not by any means disparage many excellent specimens of engines and machinery which have arrived from France, from Belgium, or from any other parts. Many of these are worthy specimens of the handycraft of foreign mechanics, and reflect credit on the countries from whence they came. They are, however, not nearly equal to the works of our own engineers, and it would be but false delicacy to ignore the fact. One pair of marine engines, sent in by the French Government, may be exempted from the general verdict of inferiority which a close and careful inspection of the whole of the machinery department prompts us to pass on the foreign branch of it. These engines are in all respects an excellent example of the mechanical ability of our neighbours, and their workmanship bears the closest scrutiny and criticism. With this single exception there seems to us to be no one item of machinery in the foreign division of the Western Annexe which will stand a comparison with those in the British division. It is satisfactory, certainly, that this country, which was the cradle of the steam-engine, should maintain its position in advance of other nations, when the steam-engine may be said to have reached the stage of strong and vigorous manhood.

As regards the Eastern Annexe, in the fitting of which most satisfactory progress has during the last few days been made, we can say that it will, when quite complete, form a great point of attraction to a very large section of visitors. It is replete with every kind of machine and apparatus as yet invented for the purposes of the agriculturist, and these are arranged in most instances so as to afford the greatest facilities for inspection, and with considerable taste.

The Royal Agricultural Society's exhibitions have, to some extent, forestalled the show of implements in the Eastern Annexe, but enough of novelty will be found therein to interest even those who have attended those admirable periodical displays. It must not be imagined either that this portion of the International Exhibition is confined to the exposition of implements of agriculture. There are, on the contrary, to be found therein a vast amount of vegetable, animal, and mineral products, shown in every stage of progress from the natural to the manufactured state, and which thus form a valuable economic museum, at once instructive and valuable.

In short, it may be said with truth of the contents of the Great International Building and its Annexes, that they form a magnificent and glorious exemplification of the world's industrial, artistic, and scientific status, while at the same time they comprise a school wherein all may study with advantage to themselves, and future good to their fellow-men.

It is to be regretted that some portions of the arrangements within the building are as yet incomplete, but in so gigantic an undertaking, dependent on so many contingencies, it would have been miraculous had the opening day found all in perfect order.

We shall take an early opportunity of commencing a consideration in detail of such of the contents of the giant structure as may fall legitimately within our province, dealing more especially, of course, with the mechanical and scientific branches of them.

The Commissioners have been peculiarly unhappy in many of the arrangements they have been called upon to make, and in their manner of making them. We would forgive them, however, for their blundering programme—on which the *Times* the other day so facetiously commented—had they only managed to admit the public, *at the public's price of admission*, a week or so earlier than they propose to do. As the laws they have framed are apparently very unlike those of "the Medes and Persians," perhaps the Commissioners may yet feel disposed to rescind that one which refers to the "first "shilling day." In respect to the free admission of exhibitors, there certainly is room for two opinions, but we think that in justice to those gentlemen, who, after all, are the creators of the show, they are entitled to season tickets free of all cost. Of the commercial success of the Exhibition there can scarcely be a doubt, so extensive has been the sale of tickets, and the argument used by the Commissioners to the effect that "justice to guarantors" cor
the refusal of free admission to exhibit
falls to the ground.

EXPLORATIONS AND DISCOVERIES IN AUSTRALIA.

MORE and more strong does the determination of the colonists of Australia seem to grow to learn the characteristics of the interior of the vast continent they inhabit. Much of tragic interest, undoubtedly, attaches itself to past efforts which have been made to accomplish that purpose, but this does not lessen the resolution to achieve a thorough knowledge of the country upon whose shores only, as it were, they are now located. The British nation ought to foster and encourage these praiseworthy endeavours, because indirectly, if not directly, it is involved in the prosperity or otherwise of its colonies and colonists.

It is in no idle spirit of curiosity that repeated attempts have been, and are being made to penetrate the hidden recesses of Australia, but rather are they prompted by the desire to open up new fields for the labours of the emigrant, and to form new media for increasing commerce with the mother country. It may be well to take a brief glance at the discoveries of the last year or two, and if our readers will but refer to an ordinary map of Australia, they will be the better able to comprehend what has been effected in this direction. The Australian departments at the International Exhibition, replete as they are with valuable products from that distant land, may quicken the desire to learn more of it than is generally known on this side the globe. Victoria, with its capital, Melbourne, is the most southerly of the Australian colonies, and South Australia, with its capital, Adelaide, lies next to it on the west. Both colonies have maintained an honourable rivalry as to who should first cross the continent due north to the Gulf of Carpentaria. First, in point of time, was Mr. Stuart, of Adelaide. Having already made one expedition, he set out at the head of a party in November, 1860, and returned in November, 1861. He reached latitude 17° 8″, and longitude 133°, or a point within one hundred miles of the gulf. The opposition of the natives, and shortness of provisions, compelled his return. He has now returned better equipped and provided than before, and has probably ere this reached the Gulf of Carpentaria.

Mr. Burke, with a similar object, set out, admirably prepared for the difficulties and dangers of his mission, but we all know the particulars of its disastrous termination. His discoveries, however, were of great practical value, and it is not too much to say that Stuart and Burke have made known the peculiarities of North East Australia, which before was as a sealed book. The name of Burke's Land has been given to the territory traversed by that brave and unfortunate man, and a monument, costing £6,000, is being erected to his memory in Melbourne. Turning to the south west, we have the colony of Western Australia, with Perth as its capital, and King George's Sound as the port at which the Peninsular and Oriental steamships touch. There Mr. Gregory is the hero of discovery. On the 2nd of May, last year, he and his party left in the Dolphin for Nicol Bay, which is just above North West Cape, the most westerly point. From this port he made a series of excursions into the interior. The party returned on the 9th of November, after having traversed no less than three millions of acres of land fit for grazing cattle and growing cotton. Wild melons, gourds, figs, and plums abounded. Tobacco grew abundantly, and palms were found in plenty. The climate, Gregory reported to be better than that of the settled colony. While the party were in the interior, the crew of the Dolphin fished rich beds of pearl oysters, and found one pearl valued at £25.

All that is now wanted is an exploration of the country between that which Mr. Gregory opened up, and the southernmost part of the Victoria river, as traced by the North Australian expedition. This done, Western Australia will be known, and all that remains to be done will be to cross the continent, or island, as some term it, from Cooper's Creek, where Burke died, to the north-west coast.

The Chief Secretary of Victoria was urged to the annexation to that colony of the ten millions of arable acres which constitute Burke's Land. Adelaide will claim all Stuart's discoveries, and Western Australia will keep the fruits of Gregory's exertions. In all there is, no doubt, sufficient new territory added by the exertions of these three men, to support, for hundreds of years to come, the surplus population of all Europe!

Who shall say that we have no interest in Australian discoveries after this? In all probability the five existing colonies will produce fifty before the nineteenth century has passed away. They have been founded within the memory of living men, and now they possess, according to the Duke of Newcastle, a population of 1,250,000, and a revenue of £6,500,000. In ten years they have exported more than £100,000,000 worth of gold, while the number of acres under cultivation has risen in the same time from 60,000 to 300,000. The export of wool, which ten years ago equalled in value £800,000, now amounts to £2,000,000. Assuredly the future of Australia is one of the greatest questions which can be considered by Englishmen, and to none is it of more consequence than the working classes of this country. What its political future may be we dare not guess. But when our children hear of the United States of *Australia*, as they undoubtedly will, we may pray that they may not have to hear also of so terrible a disruption of them as but now has occurred in the once United States of America.

POWER OR SPEED FOR THE NAVY.*

WE are not answerable for the opinions of "A "Civilian," and we do not endorse to its full extent his theory of naval construction under the regime of armour plating. We think, with some of our correspondents, he has needlessly invoked a "panic" sentiment, for which we have no sympathy. But we do think there is much truth in the view he takes of the *inadequate* constitution of the constructive branch of the Admiralty—inadequate, not in the professional knowledge of its offices as naval architects, in which capacity, we believe, they are unequalled, but in their want of experience in practical engineering, of which a perfect knowledge is indispensable to fulfil the requirements of the newly-discovered system of armour-plated ships.

Unquestionably, the construction of our military navy can no longer be under the exclusive control of purely naval architects. The naval engineer has become a necessity; it is impossible to ignore the fact, and the sooner it is acknowledged the better. The complete reorganisation of the Controller's Department requires deliberation, which will take time, but for the reconstruction of our navy there is no time to lose, and we, therefore, adhere to our opinion that the best plan to meet the emergency of the moment is to appoint a competent and independent naval armour commission.

The proposed object and action of this commission are misunderstood by many who have not materially considered the subject. Some persons suppose that, pending the experiments and inquiries of the Commission, the action of Government in creating an iron-clad navy would be suspended. This notion is a manifest error which we are anxious to remove. The proceedings of the Commission would aid, promote, and stimulate those of the Admiralty in a powerful and efficient manner. It would "*quoad*" naval armour, take the place of the Controller's Department, which, by its composition, is incompetent to advise the board on technical matters of a novel character, which are in the province of the engineer, and not in that of the naval architect or shipwright. So satisfied were Government on this point more than a year ago that they appointed the Special Committee on Iron to advise the Admiralty on the quality of iron and the capability of plates to resist projectiles. But this Committee, although its members are unexceptionable in their several professions, is defective, because they cannot devote their whole time to the duties which devolve upon them, and because it is deficient in practical engineering talent. The appointment of a properly qualified commission is of the first importance, on account of the aspect in which the question of maritime supremacy now presents itself. We must have an armour-plated navy—that is settled, but on what plan are our men of war to be built? In another part of this impression this question is raised in a form which is the very root of the discussions so eagerly entered upon in every maritime state. Is *power or speed* to be the principle for the reconstruction of our navy? In approaching this question the curtain is raised, and the truth is suddenly revealed.

A struggle for naval supremacy has for some time been silently at work at the Admiralty,—science contending for strength, routine for speed. Science is powerful, but routine is obstructive, and the contest between them has not been on equal terms. In the obscurity of official inquiry science may be stifled, but in the light of day it will be triumphant. Hence the necessity of experiments untrammelled by departmental interference. If the arguments in favour of power are to prevail, and they seem to be irresistible, the art of naval construction has passed from the domain of the naval architect to that of the constructive engineer. But the former will not readily surrender the supremacy he has so long maintained at the Admiralty. All experience proves that a special profession cannot be turned from its beaten track. The naval architect is a trained and scientific calculator, familiar with the formula of form, displacement, and sailing properties, but he is not an engineer, and speed is with him the first law, of which the omnipotence pervades every section of the controller's department. To this one idea the Warriors and Defences have been sacrificed. Half their length is unprotected, with the deliberate design of exposing the extremities, in an action at close quarters to be pounded and crushed into a heap of ruins, which would obstruct and block up the gang-ways of the ship, and cut off communication between the main and gun decks, and the bows and stern, interfering with the steerage and command; whilst the officers and men would be shut up in the fighting box.

In every class of iron-plated ship built, or under construction, speed has been the predominant idea, and if power has not in every case been sacrificed, there has been a compromise to the detriment of the service. We regret to learn that the idea of speed is again at work to perpetrate another blunder. A para-

---

* The above article was written before Mr. E. J. Reed's letter on "Iron-plated Ships of War" appeared in the *Times* of yesterday. Our next number will most likely contain observations on the letter.

Digitized by Google

graph in the *Times*, which appeared in our last number, states, "that a new design has been "made by Mr. E. J. Reed, formerly of the "School of Naval Construction, Portsmouth, "which is applicable to timber-built ships of "the smaller classes, and is approved by the "Admiralty, who have issued an order for its "immediate adoption, and have appointed the "inventor, Mr. Reed, to superintend the con-"struction of the vessels in Her Majesty's "dockyards." Here is another class of iron-plated ships added to the six or seven classes already adopted, without proper consideration. We are informed that in this case, as in the others, power is sacrificed to speed. "The "steaming power," it is said, "will be scarcely "inferior to that of the present unprotected "vessels." To attain that end, the system of armour-plating to be adopted will afford protection against hollow projectiles, but will not be of sufficient strength to keep out solid shot. We hope this design will not be allowed to proceed without further inquiry: Of what avail will a fleet of partially-plated sloops, corvettes, and gun-boats be against a single shot-proof man-of-war of the smallest size? Protection to iron-clad ships from shell *only* is a delusion; solid shot will quickly crush in their thinly plated sides, and make great gaps, through which explosive missiles will penetrate. They will be more at the mercy of their adversaries than the half protected Warriors, and their speed will only be of use to run away. Speed for attack will never in practice be made use of by these vessels, for to overtake a fully protected enemy and come within fighting range will be to seek certain destruction. Even against a timber built men-of-war, heavily armed, imperfect armour will be but a momentary advantage. So long as this theory of speed is upheld at the Admiralty, there will be no security for our navy. It is given up by other governments; ours is the only one which adheres to it. The French and the Americans are devoting all their attention to attain the maximum of invulnerability, even with diminished speed, and they are right. At this moment there is building at the Thames Iron Shipbuilding Company's yard, for the Russian Government, a powerful frigate, of about the same tonnage as the Warrior, but of diminished length from stem to stern, and broader in the beam; the speed will be a few knots less. But the loss of speed is amply compensated by strength and power. This formidable ironside will possess greater buoyancy, be covered all over with armour plates half an inch thicker, will steer better, be more handy, and altogether a more powerful and efficient sea-going man-of-war than the Warrior. This one fact speaks volumes, and gives rise to serious reflections.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER X.

Sir,—One of your correspondents thinks my letters are "charged too heavily with the panic spirit." I am misunderstood. I am no alarmist. I have no fear for England. If she drifts into troubled waters, which she often does, she soon rights herself. But a sudden change in the art of war has taken us by surprise, and stripped us of our naval defences as completely as if all our fleets were destroyed. Our lately re-constructed wooden walls, imbued with life by a matchless motive power, under the protection of which we reposed in fancied security against the navies of the world, are discovered to be useless. Iron walls of an entirely new construction are wanted for our protection. These of a sudden are discovered to be the first condition of our national life. Here is a source of danger not imagined in a panic-spirit, but having a real existence. I pointed at other nations who are hastily constructing armour-plated ships, and I urged that we ought to do the same; but so far from advising precipitation, I recommended the formation of a competent committee to ascertain the right mode of construction. It is in my recollection that some weeks ago the Mechanics' Magazine was the foremost in advising that we should "spend more money in "floating batteries, or less on land 'fortifica-"tions,'" and admitting the necessity of an iron fleet, it said, "we have a great work to do, but "let it be done thoughtfully, scientifically, "economically, and well." I could not express my own sentiments in more appropriate terms; but I would add one word, let this great work be done "*quickly*." When a rich treasure is unguarded, although robbers are not at hand, there is danger, and it is not panic but prudence which counsels immediate measures of protection. No nation may be strong or bold enough to attack England when prepared, but is that a reason for her knowingly to be defenceless? We know the fate of the strong man who slumbered—shorn of his strength. The charge against Government is not that they are supine, or unmindful of the danger, but that in a sudden emergency they are trammelled by routine. Owing to the entire novelty of a new question, two years have been lost in experimental shipbuilding without coming to any practical conclusion on armour plating. The defective organization of the Navy is not equal to the occasion. It is no disparagement to the Lords to say, that collectively or individually they do not understand the naval armour question. Nobody understands it yet. In the controller's department it is a subject on which the officials are incompetent to advise, or even to offer an opinion on which the least reliance can be placed. But my lords, by the force of usage and routine, refer all questions of construction to the controller's office, and the result which might have been anticipated has come to pass. The disciples of the School of Naval Construction, to whose professional science the reconstruction of the navy is intrusted, are not engineers or armourers, and, to do them justice, they do not lay claim to a class of knowledge in which they have not had the slightest teaching or experience. But still routine demands that all questions of construction be referred to their department. The rule is inexorable. The Lords will not assume the responsibility of action—cannot, in fact, exercise their executive power otherwise than under the advice and direction of the controller. The system, no doubt, is sound in principle, but under the peculiar circumstances which now exist, and which were not and could not be foreseen when the controller's department was constituted, the Admiralty are guided by an executive council which is unequal to its task.

Naval architects, like the members of every profession, are true to their training, and the experience of their lives; they look only to the sea-going qualities of a ship—floatation, steerage, sea-worthiness, and, above all, speed. From the entire novelty of the recent great innovation in the Shipbuilders' Art, they do not take into account the great change that innovation demands in the practice of their profession. They have to build a structure which must carry an unaccustomed weight, and keeping always in view their first principle, speed, they introduce alterations in naval construction, which raise new difficulties at every step. The extent and embarrassing nature of their difficulties are shown by the number of essays in the construction of armour-plated ships, sanctioned by the Admiralty and carried into effect. Six classes of vessels have been built or are under construction, and two other classes are contemplated. All these essays have been made in the dark. The prime condition, the *necessary* weight of armour to be carried has not been kept in view. The converse principle has been the basis of calculations for the construction of every class of ship. The naval architects laid down their own inflexible rule. The rate of speed determined the character of every class; given 16 knots an hour with the sills of the ports 9 feet above the load line, and to fulfil those conditions we have the lines of the Warrior. But the capacity of the frigate to carry her iron coat of mail was restricted to a given number of tons; if that weight were exceeded her speed would be diminished, and so to overcome the difficulty she was only half protected. This plan was a manifest absurdity, and yet before its evils were seriously considered it was applied to the construction of four vessels costing more than a million. Now, it was not panic, but routine, which caused this waste of the public money, and if it is not a proof of the apathy of Government, it is of their misplaced confidence in the worn-out mechanism of the constructive branch of the Admiralty. The Achilles or Northumberland class was the next conception of the naval architects to remedy the fatal defects of the Warrior. Sixteen knots an hour, with half protection, at an expense of twelve hundred thousand pounds, was a costly experiment. But speed must not be abandoned, and so a structure was planned of dimensions more colossal than the Warrior's, and capable of carrying armour plates on the whole of its exposed surface, and another million is to be spent in building three frigates on this model. Now, naval officers, fighting captains, who know something about the requisite qualities of a line of battle-ship, complain that the Warrior is too large, unwieldy, and unmanageable. Will the Achilles, which is larger, be more handy? And, above all, will the weight of armour assigned to the Achilles be sufficient for her complete protection? I will not enumerate the other four classes, it would be only to repeat the same remarks. But in the planning of every class the same error prevails. The Admiralty, influenced by the naval school, will have speed. Regardless of the signs of the times they tenaciously adhere to an exploded system, applicable to wooden ships, in which speed could, without detriment to the service, be allied to power. But even then the combination had its limits, for it was found impracticable to give to the three-decker, which was the fighting ship, the speed of the frigate. Now, with iron-cased vessels the incompatibility is greater, for the liner must carry not only a heavier armament, but a much greater weight of armour.

Wooden ships, so far as protection against artillery goes, are all on an equality. Wood as a material offers no resistance to iron missiles, solid or hollow, and no protection against incendiary shells. The greatest strength of construction presents no opposition to the fire of artillery, which passes through and through any part of the structure. With a wooden ship the armament is everything, the most formidable ordnance and projectiles will do its work most quickly. Speed, then, in combination with destructive armament, for a wooden ship, has its definite object, and the two united in the greatest possible degree are irresistible. The screw steam man of war combining those qualities was the *ne plus ultra* of a destructive engine afloat—it was contrived to overtake and annihilate promptly. This was scientific and intelligible. But the same principle does not hold with iron-clad ships; the material is incombustible, and there is a limit to its penetrability. That limit is the whole question; when attained in a naval structure, the result will be an invulnerable ship; but an invulnerable ship necessarily means the capacity to carry a certain weight of armour. That is the *prime* condition, to which speed must be subordinated. When a system of naval armour which shall make a war ship invulnerable, or as nearly so as possible, shall be discovered, the first problem of the new art of naval construction will be solved.

The next problem will be the best mode of construction of a ship which shall carry the required weight of armour, and combine the greatest possible speed with the best possible sea-going and fighting qualities. These problems require profound consideration, at present there exists no properly constituted body competent to examine them. Blunders on a gigantic scale have been made, at the cost of millions. Let us admit that the novelty of the circumstances, for which there is no precedent, took the Admiralty by surprise, and hurried them into an ill-considered imitation of the French iron-clad Gloires; but let us have no more blunders. Our eyes are opened; the principles of the new order of naval architecture begin to be understood. Before we hastily adopt the new classes of ships with which we are threatened, before we order new batches to be built of which speed to the sacrifice of power is the principle, let us have an Experiment Commission, so constituted as to deserve the confidence of the country.

The ideas of inventors for the construction of naval armour seem to be exhausted. The plans of your correspondents offer nothing new in principle. They repeat, in forms somewhat varying from each other, the same modes of construction, fastening, and backing, which were described and illustrated in my first letters. Not to fatigue your readers with repetition, the notices of these communications will be brief, unless they introduce some new feature.

A "Northampton Subscriber's" proposal is a dovetailed rib, holding plates by their edges, similar to Plum's and Lancaster's plans, already patented, and described in my letters, the difference being that the inventor proposes to hold several plates instead of one between the ribs, and supplies an additional holding power by means of screw-bolts tapped into the back of the plates. He also adopts tapped bolt fastenings for his ribs. Mr. Fairbairn's plates on his target No. 1, secured in that way, fell off the ship's frame when fired at, all the screw ends of the bolts sheering off at the joint of the nut and skin. There can be little doubt that a "Northampton Subscriber's" fastenings would share the same fate.

Mr. W. Hethrington, of Birkenhead, proposes a sort of trellis-work plating of bars of iron, forming, as the inventor terms it, "a web of "rolled plates of iron, interlacing each other." Admitting the possibility of manufacturing iron in that form, which, however, I much doubt, the surfaces would have so many indentations, and fit so imperfectly, that as the trellis plates could not be more than an inch thick, if even it were possible to give them that thickness, projectiles would shatter them into small fragments The mode of fastenting is a puzzle to the inventor, who with much *naiveté* gets over the difficulty by leaving it to those more practically acquainted with the matter.

Mr. Arthur Gearing's plan is open to serious objections. But mechanical art can do so much to remove apparent impossibilities, that when a plan possesses any features of merit, which is here the case, it ought not to remain unnoticed. As an intelligible description of Mr. Gearing's method requires a reference to drawings, of which the wood cuts will not be ready for this number of the magazine, it must be postponed to next week.

A CIVILIAN.

THE MINT.

AMID the shoal of Civil Service Estimates which have this week passed through the now untroubled waters of the House of Commons, there was one pertaining to the Royal Mint, and which requires some elucidation at our hands. The sum of £62,734 was on Monday night asked for, and obtained by the Government, for carrying on the coinage of the realm during the ensuing financial year. The amount, at the first sight, appears large, and especially so when the profits which must have arisen from the bronze coinage during the *past* year are taken into account. It was unfortunate, however, that some member of the House did not ask the Chancellor of the Exchequer the reason why so much money was wanted.

The truth is that a balance of £32,400 to the credit of the Mint remained in the Exchequer on the 28th February last, when the estimates generally were dated; and this sum, which principally resulted from the conversion of heavy copper, into light bronze coin, is included in the amount now voted for the service of next year. In addition to the balance named, £30,000 was voted for the purchase of old copper coin, and the other ingredients necessary for the manufacture of bronze money in 1862. Upon this last outlay, a profit of nearly 50 per cent. will inevitably be made; so that the Mint, at present within a shade of being a self-supporting institution, will inevitably become completely so during the current year. The alterations with regard to the internal arrangements of the Mint during the financial year just ended have not been great. The deputy master's salary has been increased from £990 11s. 1d. to £1,000, the maximum point, and making it, as the bakers say, "even money." The "Registrar and Accountant's" pay, which in 1861-2 was £284 3s. 1d., is in 1862-3 £294 3s. 1d.; why the odd 3s. 1d. is there we don't know, unless it be to increase the amount of book-keeping.

Four senior clerks obtain an increase of £20 between them, and six junior clerks an increase collectively of £50.

The salary of the resident engraver—a post now vacant through the superannuation of Mr. Jas. Wyou—is set down at £200, against £292 10s. which it stood at last year, and it must be acknowledged that the sum is miserably small for remunerating a first-rate artist, which the Engraver to the Mint must be—if he can be obtained at the price, which we doubt. In the Die department the number of artificers employed has been increased from 9 to 13, and this involves an increase also in the amount of wages paid, from £985 8s. to £1,346 16s. The Coining department remains *in statu quo* with the exception that the Foreman of the press-room receives now £290 per annum in place of £260.

The bronze coinage is proceeding satisfactorily both at the contractors' (Watt & Co.) mint at Birmingham, and the Royal establishment at Tower Hill. Fully two years, however, must elapse before all the old copper coin disappears from the channels of circulation, and is completely supplanted by bronze money.

The book-nest in Southampton-buildings, Chancery-lane, has of late become quite impassable. Great bundles of books are placed in the passage, so as to render it impossible for the public to get to the reading rooms. We have repeatedly called attention to the great inconvenience felt by patentees and others visiting those rooms, and hope now that the whole of the gloomy cavern is closely packed, some other premises will be obtained by the commissioners, to enable the inventors of all nations to scan the books of a library second to none in the world.

GIGANTIC CANALS IN INDIA.

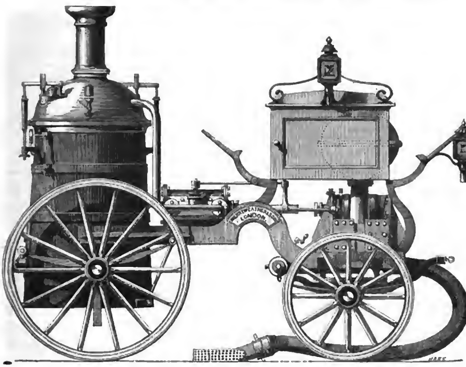
FROM Calcutta we learn that, in anticipation of the future extensive cultivation of cotton in British India, it is intended to form a number of canals for the irrigation of the districts adapted to the growth of the plant. The general scheme, proposed by Colonel Dickens, under sanction of the Government, consists in the construction of two main canals leading from a dam, to be fed by the river Soane. These will extend in opposite directions to a distance of ten or twelve miles, when they will branch off into two fan-like systems of irrigation channels, extending on one side to the Kurumnassa and Ganges, and on the other to the Poon Poou and Ganges. There will also be navigation channels for facilitating the transmission of the crops to Benares, to the mouth of the Kuramnassa, to Arrah, and to Patna. The aggregate dimensions will be 681 miles of irrigation, and 145 of navigation channels, or in all 826 miles. Through these water will flow at a speed of two miles per hour, whilst the supply will yield 3,124 cubic feet per second. The dam is proposed to be formed on the plan of the Madras Delta Works. The chief difference consisting in the depth of the undersunk foundations, which Colonel Dickens in his plan suggests, namely, two rows of blocks, 20 feet each in depth, whereas the wells at Madras range from 7 to 9 feet only. The principal impediment to the carrying out of the works is their enormous probable cost. The Colonel, however, has entered into lengthy calculations to prove that the outlay would be amply compensated for by the enhanced productiveness of the land to be irrigated, and it is likely that a portion, at least, of the scheme will soon be commenced.

As to its complete fulfilment we apprehend that that will depend much upon the future phases which the civil war in America may exhibit. The present condition of our own manufacturing districts should plead eloquently for the increased growth of cotton in India, and we should imagine that Lord Elgin could not more worthily inaugurate his succession to the Governor-Generalship than by paying immediate and practical attention to the momentous subject.

MERRYWEATHER & SON'S PATENT STEAM FIRE-ENGINE.

MENTION was made in our pages, a short time since, that Messrs. Merryweather and Son, of Long Acre, were building a steam fire-engine of great promise, for which they had obtained Letters Patent. This machine is now completed for the International Exhibition, and the preliminary trials that have taken place are highly satisfactory, the results being such as will fully sustain the reputation of this, the oldest fire-engine manufactory in the Kingdom. The carriage, which is of wrought iron, is of a novel form, combining as much lightness as is compatible with the required strength; the wheels are large, to facilitate rapid transit; the springs are of the very best description, and the frame-work of the carriage is pivoted on the fore-carriage, to avoid all possibility of straining from unevenness of the road. Between the hinder wheels is placed the boiler, made of steel, with copper tubes arranged upon the circulating principle, and so perfectly has this principle been carried out, that steam of forty pounds pressure has been generated from cold water in nine minutes. The steam cylinder, which is direct acting, is nine inches diameter, with fifteen inches stroke, working a patent double acting pump, six inches and a half in diameter. The piston carries an oil chamber, which lubricates the pump barrel at every stroke, and, passing beyond the ends of the cylinder, completely empty it, so that any grit or other foreign substances that may be drawn up with the water are at once ejected; the suction and delivery valves are all placed in easily accessible valve-chambers beneath the pump barrel. The mode of working the slide valve is novel and ingenious, permitting any required speed, from one to one hundred and fifty double strokes per

MERRYWEATHER & SON'S PATENT STEAM FIRE-ENGINE.



minute, to be obtained at pleasure without the use of any fly-wheel. The prevalence of wind has of late been very unfavourable for trials of fire engines; however, with single jet of 1⅜ inch, 1¼ inch and 1½ inch, most satisfactory results have been obtained. The latter jet, held at an angle of about 35° was projected over an intervening building, to a horizontal distance of 216 feet; the engine lifting by suction 14 feet perpendicular, and half a gale of wind blowing dead against the jet. Such a performance has never before been achieved in this or any other country.

We are requested to correct an error in our accounts of the fire-engine trials given at page 279 of our last. It was there stated that Mr. Hodges's engine threw a jet to a horizontal distance of 190 feet, and that Mr. Merryweather's railway fire-engine "fell short" of that performance. We are assured that the railway fire-engine projected the water ten feet beyond the distance reached by Mr. Hodges's engine; and that in a trial against a tall chimney shaft, the performance of the railway fire-engine was only about 15 feet below that of the brigade steam fire-engine; and it was confidently stated that if the railway engine had been prepared for the trial and well manned, the steamer would scarcely have held the supremacy. A full description of the railway fire-engine, the most powerful hand-worked engine ever constructed for land service, appeared in the MECHANICS' MAGAZINE, No. 987, July 9th, 1842.

THE WOLF ROCK LIGHTHOUSE.

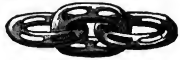
BETWEEN the Lizard Point and Scilly Islands, at a distance of about 22 miles from each point, there exists a dangerous rock called the Wolf. It is about 58 yards long and 38 yards broad at low water; bold and steep too on all sides. The set of the tides in the locality varies towards every point of the compass in the course of twelve hours; ordinary springs run very rapidly, and during S.W. gales and stormy weather, there are furious eddies, making it very hazardous to approach within a considerable distance of the rock; the rise of tide at such times is also full ten feet above the ordinary springs. The sea roars terrifically, as with the full force of the swell of the Atlantic it precipitates itself against the rock. In calm weather the noise is heard at a great distance. The rock therefore is very difficult of access, except in very fine weather. It was only after long, patient, and persevering toil, that the attendant difficulties were surmounted about twenty years ago, and a beacon was completed, having the centre of its globe 24 feet above the level of the sea at high water. Portions of the wrecks of several vessels jammed into the interstices of the rock were discovered, and told a fearful tale of the loss and property on this treacherous rock. It was found that the beacon was so frequently completely buried in the waves that to make it effective it would be necessary to give it greater elevation. In 1848, the stone beacon was cased outside with thick iron plates, (perforated,) and a new iron mast and globe erected, with the centre ten feet higher than the former one. The total cost incurred in the erection of this beacon, with the last improvements, was £11,298 4s. 1d.

It has long been desired that a lighthouse should be substituted for this beacon, and in the course of last autumn steps were taken by the Trinity Corporation for commencing operations on the Wolf. The diameter of the base of the lighthouse will be 40 feet; over nine tenths of this space the rock has to be squared down to 3 ft. 6 in. below the level of the upper point of the rock, and over the remaining tenth of the diameter 1 ft. 6 in. deeper, so that the lower courses will be built five feet into the solid rock, and sixteen feet below the level of high water springs. The first nineteen courses bringing the tower up to 38 feet from the base, will be of solid granite, the diameter of each succeeding course being reduced by 9 inches, that of the tower at the above elevation is reduced to 25 feet at this level, and on the south-east side of the tower will be the entrance door, made of strong metal, and fitting so exactly as to be perfectly impervious to water, and capable of resisting the utmost impetuosity of the waves. The ascent to the door is by thirty-six metal steps, built in with the solid granite. From the level of this entrance door a circular staircase, left out of the centre of the solid, leads to the water-room, the floor of which forms a landing place for stores. The thickness of the walls of the six rooms above the solid decreases gradually from six feet to two feet, the height of each room being ten feet, with each stone floor forming an arch overhead, and nine inches thick —all granite,

In the store-room is a crane for hoisting in the supplies,—this is ingeniously contrived to launch out, when required, and when not in use it is completely housed, leaving the aperture through which it slides impenetrable by water. The parapet will project two feet, forming a gallery 3 ft. 6 in. round the lantern, with a strong metal rail surrounding it.

The lantern will be 19 feet high and 14 feet diameter, resting on a five feet pedestal, and surmounted by a five feet cowl and four feet gilt vane. The roof and framework of the lantern are of gun-metal. The centre of the lantern is to be 110 feet above high water spring tides. The crest of the waves, however, will frequently go clean over it, as proof of which, the fog bell affixed to the gallery of the Bishop Rock Lighthouse—one hundred feet above the level of high water mark —was broken off by the sea in a heavy gale of wind during the winter of 1860. The part from which it was broken will be amongst the remarkable curiosities at the great Exhibition this year.

LONGHURST'S PATENT CABLE CHAIN



THE above engraving represents three links of a chain constructed according to a patent recently obtained by Mr. J. Longhurst, of Ticehurst, Sussex. The metal is so disposed of as to impart great strength, and to resist in the highest degree the strain upon a chain when a ship is riding heavily. The metal forming the studs at each end and sides of the links, as clearly shown in the fig., is crossed in grain, whereby the links are prevented from drawing out or collapsing. A chain made to this pattern from 1⅛ inch round iron, stood a strain of 58¼ tons before breaking. Chains of this pattern have the advantage of being light, combined with great strength, they are also easily handled, and will lock to the smallest capstans.

INSTRUCTIONS FOR THE MANAGEMENT OF HOSE-REELS, FIRE-ENGINES, &c.

BY STEPHEN ENGLISH, late Chief Constable of Leeds.

THERE are few subjects of greater importance, or that demand more attention, than the fire-brigades of this country.

Having, during my residence in Leeds, witnessed the great confusion arising from the want of a well-organized system, I determined, a few weeks previous to my leaving, to draw up the following suggestions as the basis of general rules and regulations for the management and guidance of the police at all fires, which will also be found applicable to the fire-brigades throughout the country.

To insure promptitude and facility of application, I have arranged the streets of the Borough in alphabetical order, showing the exact situation of the fire-plugs, with the respective distances from the wall, the size of the mains, and the pressure by day and night.

The evils resulting from divided authority, want of both unity and co-operation amongst the various brigades, and the delay on all occasions in reaching the scene of the fire, convince me that in a large manufacturing town like Leeds, it is of the utmost importance that an efficient and well-organized fire-brigade should be established.

With the powerful pressure of water available in the mains, and the number of police stations throughout the Borough, requiring only a hose-reel at each (thus possessing the means of prompt action), there is no town in England where an efficient fire police could be supported with comparatively less cost.

Should the following suggestions induce the authorities of Leeds to carry these arrangements into effect, and awaken them to the necessity of a more efficacious protection for life and property, I shall, at the close of my career, as Chief Constable of this Borough, feel that I have attained an object not unworthy of laudable ambition, and trust that I shall leave beh a lasting proof of my anxiety to benefit the inhabitants of this large, important, and influential town.

DESCRIPTION OF A HAND HOSE-REEL.

A hose-reel is a machine of the lightest possible construction, adapted for carrying hose and implements for extinguishing fires, where high pressure is available.

The hand hose-reel consists of a pair of high wheels and springs, wrought iron axle, upon which a drum revolves, to carry the hose, the whole being surmounted by a box to hold the necessary implements, viz.:—Stand-pipe, with stopcock key and crowbar; portable hand-pump, with short length of hose; branch-pipe, with ¾-in. jet; spade; measuring-tape; six hose wrenches; ladder clip; a roll of sheepskin strips; a ball of tarred twine, and a bundle of leather washers. When ready for use the hose is connected by the couplings into one length, and coiled on the drum of the reel, leaving a swivel screw outside; all the implements, perfectly clean, being in their places in the box.

INSTRUCTIONS FOR THE MANAGEMENT OF HOSE-REELS, WITH THE DUTIES OF THE POLICE AT FIRES.

1.—*Duties of Police.*—Every man in the police force is expected to make himself thoroughly acquainted with the management of the hose-reel, stand-pipe, implements, and hose-piping, and to have a perfect knowledge of the exact situation of all the fire-plugs.

2.—*Notice of Fire.*—When a fire occurs, the policeman on duty in the neighbourhood should proceed immediately (if he cannot obtain a conveyance) to the central police office, and despatch the first policeman he meets to tell the other fire-brigades and call the turncocks. Should he not meet an officer on his way, the reserve at the office, or the man on the adjoining beat, must forward the information.

3.—*Sending Messenger.*—But if the policeman can procure a reliable messenger he should remain on the spot to obtain assistance, and prohibit the unnecessary interference of inexperienced persons, and close all doors, windows, and other openings, to prevent the fire from spreading, until the arrival of the reels.

4.—*Preparing Fire Plugs.*—While waiting the arrival of the reel, the officer should get ready the nearest fire-plug, or fire-plugs, so that the stand-pipe can be attached without delay. Attention to this rule is especially important, when the plugs are frozen or covered with snow; when frozen up a little hot water will open them.

5.—*Ordering Reels.*—In the absence of the Chief Constable, the duty of ordering out, and determining the number of reels for a fire, devolves entirely upon the superintendent of the fire-brigade, who is responsible for any omission or neglect.

6.—*Dragging Reel.*—The reel can be drawn to the place by one or two men, and when extra assistance is required the drag rope should be used, by means of which ten men can assist, care being taken that no person is allowed to push the reel from behind.

7.—*Duties of Men Drawing Reel.*—The man on the left of the drag handle is No. 1, and he should attach the stand-pipe, &c.; the man on the right is No. 2, and should assist in uncoiling the hose, and subsequently take charge of the branch pipe.

8.—*Finding Plugs.*—By the measuring tape, No. 1 can find the exact situation of the plug in all weathers, and he is accountable for the proper working of the plug during the fire.

9.—*Fixing Stand Pipe.*—It is the duty of No. 1 to fix the stand-pipe to the fire-plug nearest the premises on fire, and connect the hose to the stand-pipe. But before the hose is connected, the water should be passed through the stand-pipe to force out any stones or dirt which would otherwise obstruct the free passage of the water at the jet.

10.—*Connecting Hose.*—While the men are moving the machine as near the fire as convenient, No. 2 should follow the reel, uncoil the hose a sufficient length, then disconnect it at the nearest coupling, attach the branch pipe, and signal to No. 1 that the whole is ready for the water to be turned on.

11.—*Turning on Water*—No. 1 should turn the water gradually on, as the sudden pressure is apt to burst the hose piping, The same precaution should be observed in turning off the water, to avoid the recoil in the mains.

12.—*Reel, where left.*—The Reel should be brought back to the fire-plug, and left in charge of No. 1, who is accountable for both it and the implements in the box.

13.—*Avoiding Bends and Curves.*—In uncoiling the hose, angles and bends should be avoided, but when necessary, the bends should be uniformly curved, and of the greatest possible radius. Whilst moving the hose when full, care should be taken to lay hold of the loops to prevent damage.

14.—*Two Jets.*—When working from a large main two jets, if required, can be obtained, and much hose saved by fixing a double connecting screw at the nearest coupling to the branch, instead of attaching the hose at each side of the stand-pipe.

15.—*Duties of the Superintendent of Fire Brigade.*—The superintendent of the Fire Brigade should confine himself solely to directing and superintending the necessary operations, for much depends upon his intelligence, coolness, and presence of mind.*

16.—*Observing Premises.*—The superintendent, on his arrival, should carefully observe the situation of the premises on fire with the adjoining buildings, and the available supply of water, to enable him to plan out the best and quickest means of extinguishing the fire. To prevent it extending should be his chief aim.

17.—*Playing with the Wind.*—When practicable it is better to place the branch pipe in such a position that the jet may be assisted by the wind.

18.—*Application of Water.*—The branch pipe should be brought as near as possible to the premises on fire, and when the firemen cannot enter the house by the staircase, scaling ladders should be used to bring the jet to bear directly upon the burning mass—a matter of the greatest importance in extinguishing fires, for unless you play with full power upon the burning materials, and thus cut off the flame at its source, you uselessly deluge the building with water. It is the *force* of the water, and not the *quantity*, that has the greatest effect.

19.—*Encircling Fire.*—In many instances it will be advisable not to play immediately into the body of the fire, but as far as practicable gradually to encircle the flames, fire having a tendency to diffuse itself in every direction.

20.—*Supporting Hose, &c.*—The hose can be supported on ladders by ladder clips. Strips of sheepskin and balls of tarred twine are kept in the reel box to bind around the hose in cases of damage or leakage. The tube torches placed on the ground will protect the hose from accident or wilful damage.

21.—*Calling Turncock.*—At every fire the turncock of the district should be called, as he can frequently, by shutting off the adjoining "services," give a better supply with greater pressure.

22.—*Residences of Firemen.*—The names and residences of the men composing the brigades of the insurances offices, and of the turncocks, are inserted at the end of this book, to enable the police to give them immediate notice of a fire.

23.—*Small Fires, how Extinguished.*—The mains should not be turned on to extinguish small fires, as in many instances the hand pump carried with each reel will be found sufficiently powerful for such occasions, as they throw from six to eight gallons of water per minute to a height of from thirty to forty feet, and can be used in any position.

24.—*Using too much Water.*—The superintendent of the fire-brigade should carefully avoid using more water than is absolutely necessary for extinguishing the fire, as it too frequently happens that more damage is done by water than by the fire, owing chiefly to inattention, want of discipline, and divided authority. A gallon of water judiciously used is better than a tun misapplied.

25.—*Size of Mains.*—The size of the mains and pipes is given in this book, which will be some guide to the superintendents of the fire brigades as to the number of jets they can bring to bear upon the fire.

26.—*Power of Water by Day.*—They should also bear in mind that when the "services," are in full draught, as in the day time, when the town is drawing from the pipes, the effective "head" is not so great as at night, and they should fix on fewer jets accordingly.

27.—*Police Duties at Fires.*—The chief constable and the inspectors on duty, with a sufficient number of the police, must attend all fires, for the purpose of keeping order, protecting property, and aiding, by every means in their power, the exertions of the firemen. They should also take possession of the ruins after a fire, especially protecting all salvage.

28.—*Fire Ropes.*—Fire ropes are kept at each police station to place across streets and openings in the vicinity of the premises on fire, to prevent the crowd from interrupting or interfering with the arrangements of the fire-brigades. The wire ropes can be extended to any length by means of the spring hook at each end.

29.—*Robberies during Fires.*—To prevent the commission of offences during the temporary absence o the police, the inspector in charge should take the precaution of sending men on special beats when their services can be dispensed with at the fire.

30.—*Civility.*—During the fire the police should give their whole attention to their duties, and not stand idling or talking to each other, or to persons in the crowd. They should discharge their duty in a firm, decided manner, but with the utmost forbearance, good temper, and coolness. When spoken to they should not reply in an abrupt, uncouth manner, but with the greatest civility and politeness, always avoiding irritating language.

31.—*Duties of Officers.*—The inspectors and sergeants should be vigilant in detecting and reporting any man who neglects the strict performance of his duty. Upon the superior officers, too, devolve the duty of setting the example of sobriety and rigidly enforcing discipline. A laxity on their part will be followed by a corresponding indifference to duty on the part of the men. In their intercourse with the men forbearance and civility, characterised by firmness and decision, will ensure prompt obedience, respect, and confidence.

32.—*Refreshments.*—The chief constable should have the power to allow coffee and bread and cheese as refreshments for the men when they have been engaged on fatiguing duty at a fire for many consecutive hours, or performing extra duty, which prevents them from attending their meals.*

33.—*Co-operation with Firemen.*—The most cordial co-operation and good feeling should exist between the police and the fire-brigades belonging to the insurance offices; and a policeman using any incivility towards the members of other brigades will be punished severely.

34.—*Investigating and Reporting.*—On every occasion of fire, the inspector of police on duty should investigate on the spot the cause or origin of the fire, with the full particulars of the means taken to extinguish it, the amount of damage done, and the conduct of the police there, entering the same in the "Fire Journal," kept for that purpose at the police office.

35.—*Attention to Hose.*—After the fire has been extinguished, the hose should not be dragged along the ground, but carefully coiled up in lengths, with the swivel screw outside, and taken to the central office to be cleaned. The leather pipes after being used must be washed clean, hung up to drain, and while partially wet, a mixture of neatsfoot and cod oil rubbed on with a brush. The canvas hose must also be washed clean, hung up to drain, and not folded up until perfectly dry. After cleaning the hose, the couplings should be polished, and the leather washers inside the swivel couplings carefully examined before the lengths are connected on the reel.

36.—*Damaging Couplings.*—The lengths of hose should never be thrown on the ground in a careless, hasty manner, as the least violence will damage the thread of the male coupling.

37.—*Keeping Hose.*—The hose should be taken off the reels at least once in every two months, folded up in lengths, with swivel screw outside, and kept exposed in an airy place. When kept too long coiled on the reel, the leather is liable to heat and harden. Leather hose will keep best in a cool place; canvas hose in a dry place.

38.—*Care of Implements.*—It is the duty of the superintendent of the fire-brigade to keep the reels, hose, and implements in good condition, and fit for use, and after every fire he should examine them, and have any little repairs that may be required done immediately. He should also frequently inspect the fire plugs and direction plates throughout the borough, reporting any defects, or anything not in working order.

39.—*Superintendent during the Day.*—In the daytime the superintendent of the fire-brigade should never leave his residence without first writing on a slate, hung in a conspicuous part of his house, the time he left, where he may be found, and the route by which he may return.

40.—*Fires in Chimneys.*—Fires in chimneys can easily be extinguished by throwing a handful of powdered brimstone on the fire in the grate, immediately placing a board, or, what is much better, a wet blanket, so as to cover the opening entirely, to prevent the fumes descending into the room. The vapour of the brimstone ascending the chimney will effectually extinguish the soot on fire. If the sulphur cannot be obtained readily, throw on the fire a quantity of salt. If the ends of joists, or beams, or any woodwork be in the chimney, the hand-pump can be used with advantage.

---

* Too frequently superintendents of fire brigades perform acts of daring, or perhaps take the branch pipe and place themselves in a conspicuous position to obtain the applause of the spectators, instead of bringing to bear their experience, intelligence, and judgment, in preventing the destruction of valuable property.

* My experience, attending fires for many years, convinces me that the use of spirituous liquids at a fire is decidedly improper. Upon some men it has the effect of stupifying and deadening their senses, rendering them incapable of efficiently discharging their duties; some it makes careless and reckless of their own lives and the lives of others, whilst many men become regardless of the effects on their health, remain in their wet clothes, thus sowing the seeds of rheumatism and other diseases; others, not satisfied with the quantity they receive, subsequently take an extra drop, and too frequently have to repent at leisure the consequences of their indiscretion when drunk. The clear brain, the active nerve—so necessary at fires—are his only who carefully abstains from taking intoxicating liquors.

41.—*Fire Plugs in the out townships.*—Fire plugs placed in roads where boards cannot be affixed, should have their position denoted by a painted mark on the side of the nearest lamp-post, or a zinc plate hung from the top edge of the lamp.

INSTRUCTIONS FOR MANAGING THE FIRE-ENGINE.

1.—*Engine.*—The engine, hose, and implements should always be ready for immediate use.

2.—*Near Water.*—Upon the arrival of the engine at a fire, if the supply of water is to be obtained from a river, canal, pond, or other like source, the end of the engine must be placed near the water.

3.—*Elbow Suction.*—If on a narrow towing path, place the engine sideways to the canal, fixing on the elbow suction joint before the lengths of suction pipe are attached.

4.—*Fed from Main.*—When the engine can be fed from a main or service pipe, place the engine as near as possible to the premises on fire, consistent with safety, the object being to obtain greater power. When fed from a main the portable cistern should be placed on the ground near, but out of the way of the folding levers. Fix the stand pipe to the nearest fire plug, and attach sufficient hose to reach the cistern, then fix the goose neck to the last screw coupling, and hang it on the cistern.

5.—The engine can be worked in a similar manner from its own cistern.

6.—*Position of Men.*—The men sitting on the left or near side of the engine attach the hose for the delivery of the water. The men sitting on the right, or off side, attach the suction pipes for the supply of water.

7.—*Handing out Implements and Hose.*—When the delivery hose is to be attached, one of the men on the left side jumps upon the engine, hands out the hose-wrenches from the driving seat, and then gives out as many lengths of hose as will reach the fire.

8.—*How laid out.*—The man who receives the first length attaches it by the swivel coupling to the engine, and uncoils it in the direction of, and with his face towards, the fire. The next man, knowing the exact distance the first length will reach, commences from that point, uncoiling his length also towards the fire. The other men act with their respective lengths in a similar manner until the fire is reached and the branch pipe attached.

9.—*Suction Pipe.*—The suction pipes are attached by the men on the right of the engine in a similar manner, care being taken that the lengths of suction are screwed up tightly to prevent them from drawing or sucking air.

10.—*Working order.*—When the fore-carriage is locked, the clip which supports the lever unfastened, the bearings oiled, and the inside of the engine examined to see that the piston rods can work freely, the engine is ready for use.

11.—*Levers not to be Lifted.*—The men working the engine should commence pumping slowly, gradually quickening the movement and increasing their power, throwing all their weight on the down stroke and allowing the handles to rise by the depression of the levers on the opposite side.

12.—*Assistants.*—When a sufficient number of assistants has been secured to pump, the police are relieved, except the man selected to be left in charge, who should always be able to write, and thoroughly understand the working of the engine; he should keep an account of the time, and the names and number of men employed, and upon no account suffer idlers to stand about or interfere with the men pumping. The fire ropes will be found useful in keeping the crowd back, and should always be used.

13.—*Suction Strainer.*—When the supply is obtained from a pond or other source, care should be taken to prevent straws or other articles passing through the strainer into the works. To obviate this a hamper or wicker basket should be procured and fixed over the strainer.

14.—*Folding up Hose.*—The same order should be observed in coiling up the hose as in laying it out, keeping the swivel screw outside.

15.—*Cleaning Engine.*—On returning from a fire, the engine should be immediately washed before the dirt has time to harden, and clean water pumped through the works, moving the levers rapidly to remove mud, grit, &c.

16.—*Cylinders.*—After wiping all dry and clean, the pistons should be covered with salad or olive oil for lubricating the cylinders and keeping the leather cups moist.

17.—*Experiments with Fire Engines.*—In experiments with fire engines water can be thrown to a greater elevation by a slight inclination of the jet pipe, as when the branch is placed perpendicular the force of the water is diminished by the weight of the descending fluid.

Proceedings of Societies.

INSTITUTION OF MECHANICAL ENGINEERS.

The general meeting of the members of this Institution was held on Thursday, the 24th ult., in the Lecture Theatre of the Midland Institute, Birmingham; Alexander B. Cochrane, Esq., Vice-President, in the chair.

The Secretary (Mr. W. P. Marshall) read the minutes of the last meeting, and a considerable number of new members were elected.

The first paper read was "On the Construction of Lighting Apparatus for Light-houses," by Mr. Armand Masselin, of Birmingham. The old catoptric or reflecting lights, in which a number of silver-plated parabolic reflectors are used, with a lamp in the focus of each, are now being generally superseded by Fresnel's more perfect dioptric or refracting system, in which the rays of light from a single central lamp are refracted in a horizontal direction by a series of glass lenses and annular prisms, undergoing total reflection within the prisms. By this means the whole of the light is made use of in the direction in which it is wanted, and its efficiency is thus greatly increased, the metallic reflectors being much inferior not only in consequence of their absorbing a large proportion of the light in reflection, but also on account of their wearing out with cleaning, whilst the dioptric apparatus suffers no perceptible deterioration. The lamp consists of an oil cylinder containing a weighted piston fitted with a cupped-leather packing, the pressure of which forces the oil up to the burner in a quantity several times greater than that consumed, in order to preserve the wicks from becoming charred; the overflow oil is returned into the cylinder, and the piston on reaching the bottom is wound up again by a rack and pinion. By a simple arrangement for regulating the supply of the oil and filtering it in its passage to the wicks, the maintenance of a constant and regular light is thoroughly ensured, with ordinary attention on the part of the keeper, as proved by the completely successful results of many years' working. Above the lamp a ventilating tube extends up into the cowl of the lantern, for producing the requisite draught to support the combustion of the lamp; it is made with inverted funnels at intervals, opening downwards, which prevent the effect of any sudden gust of wind from reaching the lamp. In revolving lights the optical apparatus is carried on a revolving platform driven by clockwork; and the lenses and prisms, instead of distributing a zone of light of equal intensity all round the horizon, as in fixed lights, are arranged in such a manner as to concentrate the light in the centre line of each of the eight faces of the apparatus, producing a succession of brilliant flashes at regular intervals as the apparatus revolves. The lantern containing the light is glazed with panes of thick plate glass, and the standards in which the glass is fixed are inclined alternately right and left, so as not to intercept the light completely in any vertical plane, while the lantern itself is thereby stiffened. A specimen of one face of the apparatus containing the lenses and prisms of a revolving light, was exhibited from Messrs. Chance's glass works, and also a specimen of the pressure lamp used for the most powerful lights.

The next paper was "On the coal and iron mining of South Yorkshire," by Mr. Parkin Jeffcock, of Derby; giving a description of the geological nature of the district, and of the position and extent of the principal seams of coal and beds of ironstone, with a statement of the localities where each is mostly worked. The South Yorkshire coalfield forms the continuation northwards of the Derbyshire coalfield, the principal coal seams being clearly identified with corresponding seams in Derbyshire. The two most important seams are the Barnsley Thick coal of about nine feet thickness, and the Silkstone of about five feet thickness: the former is a fine steam coal, and is the same seam as the Top Hard coal of Derbyshire, worked at Staveley and elsewhere; and the latter is an excellent household coal, and the same seam as the Blackshale coal of Derbyshire. The ordinary modes of working the coal in the district were described, all of which are more or less defective, requiring a large amount of the coal to be left in the mine for supporting the roof during the working; and at some collieries these are now abandoned for the superior "long wall" system, in which the coal is worked in a single face of great length, and the whole of the coal is got out at one operation, the roof being supported immediately behind the working face by timber props or by pillars built up of the rock, and in some cases cast-iron puncheons or props are now used, of which a full-size model was exhibited. The ventilation of the mine is also considerably simplified in the "long wall" system. The quantity of water met with in the district is in general not large, and there are few collieries where large pumping engines are required; but the coal seams are of a very fiery character, evolving great quantities of inflammable gas, and the greatest precautions are necessary to prevent explosions. The most terrible explosions have taken place in the Barnsley Thick coal, the most important seam of the district; this and the Silkstone seam being specially liable to sudden and powerful emissions of gas. In most of the collieries safety lamps are now used exclusively; and the ventilation being produced by a furnace at the bottom of the upcast shaft, the air from the mine is conveyed into the shaft by a separate passage or "dumb drift," so as not to pass through the fire of the furnace, which is supplied with nothing but pure air direct from the downcast shaft. At some of the mines near Barnsley large fans driven by steam-power are employed, which form a simple and efficient means of mechanical ventilation, and have worked continuously with complete success for several years.

The last paper was a "Description of a Feed-Pipe Connection for Locomotive Engines," by Mr. Alexander Allan, of Perth, consisting of a simple brass or copper tube of elliptical section, bent into a circle of large diameter, for the purpose of allowing the usual amount of play in all directions between the engine and tender, and saving the expense and trouble of the ordinary ball-and-socket couplings, whilst being more durable than the flexible hose-pipes. The new couplings have now been at work for nearly a year on the Scottish Central Railway, and have proved completely satisfactory. A specimen was shown of a tube of circular section, which had been taken off the engine for exhibiting at the meeting, showing not the slightest sign of giving way at any part after nearly a year's work; a new tube of the elliptical section was also shown.

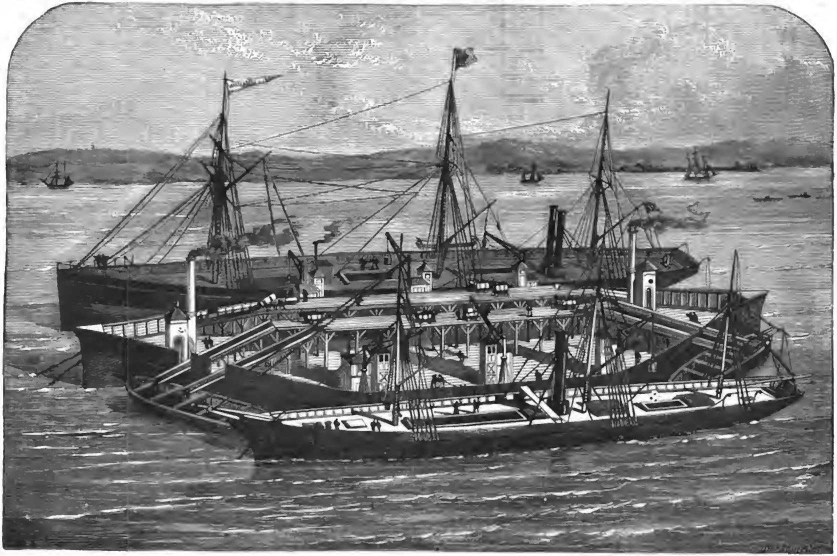
The meeting then terminated.

MEETINGS FOR THE WEEK.

Mon.—*Royal Inst.*, General Monthly Meeting at 2 p.m.
United Service Inst., "On the Shape of Sword Blades," by Mr. J. Latham, at 8.30 p.m.
British Architects, Annual Meeting of Members.
Tues.—*Inst. Civil Engineers*, I. "On the Sea Dykes of Sleswig and Holstein, and Reclamation of Land from the Sea," by J. Paton, Esq. II. "On Reclaiming Lands from Seas and Estuaries," by J. Oldham, Esq. III. On the same subject, by J. H. Muller, Esq., at 8 p.m.
Royal Inst., "On Ancient Art," by C. T. Newton, Esq., at 4 p.m.
Wed.—*Society of Arts*, at 8 p.m.
Geological Soc., I. "On the Discovery of a new and large Labyrinthodont in the Gilmerton Ironstone of the Edinburgh Coal-field," by Prof. T. H. Huxley. II. "On the Land Flora of the Devonian Period in North-east America," by Dr. J. W. Dawson.
Thur.—*Royal Inst.*, "On Progress: Chemical Arts, 1861, 1862," by Dr. Lyon Playfair, at 3 p.m.
Royal Soc., at 8.30 p.m.
Antiquaries, at 8.30 p.m.
Architectural Association, "On Photography in relation to the Fine Arts," by J. Leighton, Esq., F.S.A., at 8 p.m.
Fri.—*London Inst.*, "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.
United Service Inst., "On Military Training," by Lieut.-Col. A. C. Robertson, at 3 p.m.
Sat.—*Royal Inst.*, "On Agricultural Chemistry," by T. Anderson, Esq., at 3 p.m.

The International Association of Decimal Coinage have succeeded in making a perfect collection of the coins, weights and measures of all countries, which will be exhibited in connection with the class of Philosophical Instruments at the International Exhibition.

The Philadelphia *Ledger* states that there is an iron submarine boat in that city, shaped like Winan's cigar steamer, which is intended to operate against the Merrimac under water. It is capable of being moved under water, and remaining without communication with the atmosphere for about six hours.



A FLOAT FOR DISCHARGING VESSELS.

A FLOAT on an improved principle has recently been patented. It is fitted with machinery for discharging screw colliers and other vessels with great rapidity in the stream. It is also fitted with Sir William Armstrong's hydraulic cranes, and provided with other machinery and apparatus for screening the coals, when required, and depositing them into barges without breakage.

Two steam colliers of the largest dimensions may be discharged at once. By suitable arrangements of the hatchways and holds of the steamers, three cranes may be worked on each steamer at the same time, and each crane can discharge 60 tons of coals per hour.

The owners, Messrs Willliam Cory & Son, Commercial-road, S., are prepared to undertake to discharge steamers not exceeding 1,200 tons cargo in ten hours, night or day. They have similar machinery on fixed buildings in operation at the Victoria Docks. Builders and owners of steamers can obtain from Mr. Adams, engineer, 1 Grove-hall-terrace, Bow, E., the requisite particulars for the adaptation of their vessels. A model may be seen at the "International Exhibition," Class 10.

CAPTAIN COLE'S CUPOLA SHIPS.

FIG. 1.

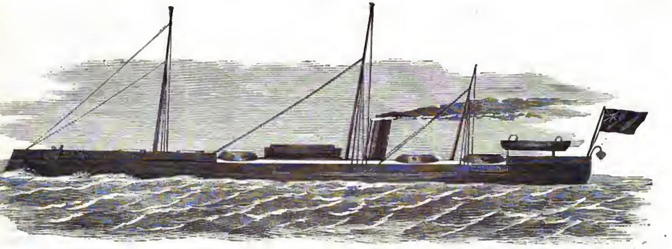


FIG. 3.

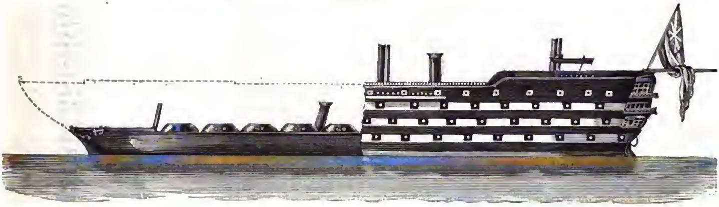
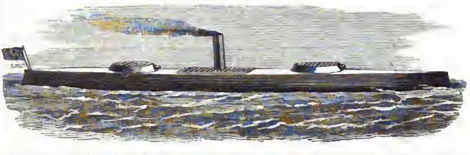


FIG. 2.



CAPTAIN COLE'S CUPOLA SHIPS.

CAPTAIN COLE's invention of cupola ships, which was submitted to the Government in 1859, and which has recently created considerable controversy, was fully described and illustrated in our pages (Nos. 47 and 81, New Series, 1859 and 1860). In addition to the information there submitted to our readers, we beg to draw attention to a cupola ship for foreign service, Fig. 1, showing the side plates let down for action. Fig. 2 shows a boat for coast defences. It is filled with two shields capable of mounting two guns each. Fig. 3 represents a three-decker partially reduced and converted into a shield of large dimensions. The following remarks, sent by Captain Coles to a contemporary, are interesting :—

Since giving the lecture on this subject in June, 1860, much has come to pass, and I am pleased to be able to say that all my statements have been proved, and more especially the last paragraph. As various reports have been made relative to my vessels being sea-going, I will shortly describe their rig—1. The mast I propose to be of iron, peculiarly constructed, requiring very little rigging, indeed, only one large lower shroud of a side, and one topmost backstay; the masts are all in one, on the polacca principle, with a Cunningham topsails. The masts and yards for the three classes of sea-going ships are all the same size—lower yards being 70ft., topsail yards 60ft., enabling ships to supply each other on foreign stations with a spare yard. In rigging these vessels it has been my study to give the greatest amount of canvas with the least area of masts and yards when steaming head to wind. The manner in which our line-of-battle ships and frigates are now rigged retards them greatly, if not paralysing their movements altogether when sailing under steam in boisterous weather.

The section of the three-decker cut down shows the space on the lower deck of each side of the shield—viz., 16ft. each side; this is a clear space fore and aft, allowing the half of the ship before the engines for the men's messes, and abaft for the officers' cabins. This is the plan I originally sent in to the Admiralty in 1859, but later I devised a double or cellular side, as shown in lecture at the United Service Institution in 1860. The ventilation of this ship is the same as any other flush-deck vessel—by means of hatchways, with the addition of each cupola acting as a gigantic ventilator, the top of the cupola having an opening of 9ft. diameter protected by bars, and the sides open to the lower deck, admitting on all occasions a clear current of air besides the one through the hollow pivot. Doubt has been expressed as to inconvenience from concussion or smoke. The one on board the Hazard at Portsmouth, with two 110-pounders, was covered over and around the openings with a tarpauling, both guns were fired simultaneously, with the usual crew of seven men to each gun and six lookers on inside, when not the slightest inconvenience was experienced from smoke or concussion. The conversion of heavy frigates and line-of-battle ships, constructed on the old model, into iron-plated vessels, fitted with my shield, could be effected at a comparatively small cost. As regards their capacity for carrying heavy ordnance, Sir Wm. Armstrong truly said in his letter to the *Times*, this cupola solves the problem of working the heaviest guns—indeed, it gives unlimited power of applying mechanical means and engineering skill to the working of the gun, which is under such perfect control that it could be fired easily when it would be impossible to do so with a gun fitted in an ordinary port. Indeed, I believe there is no limit, and I hope soon to have an opportunity of proving that I can work the 150-pounder gun of 12 tons as easily as we now work the two 110-pounders in one shield. This shield weighs, with guns complete, 75 tons; but I believe the size of the gun, as far as working it, to be unlimited. It is merely a matter of fewer and larger guns and shields; when it is evident, from the results at Shoeburyness with 150-pounder on the Warrior's sides, that a ship carrying one of these shields and guns would take her.

Guns used on the shields should be the best the country can supply; muzzle-loaders are preferable to the present breech-loaders; they will be in the Royal Sovereign and Prince Albert. The latter ship is named by the special request of Her Majesty.

HOW TO SET A HEN AND HOW TO PRESERVE EGGS.

The following is from *The Irish Country Gentleman*, by A. Henderson:—When a hen of any description is to be set with eggs, the place ought to be well cleaned out, and a nest made of short clean straw. Some give eleven eggs, others thirteen, and even more, according to the size of the hen, yet in most cases she will manage eleven eggs best; but let the lot consist of an odd number, and be all about the middle size. Carefully examine every egg, by holding it up betwixt you and the sun or candle, so that the tread, so-called, if present, may be seen; if not visible, the egg must be rejected; reject also those that have a circular flaw, which is indicative of a double yolk. Should a given number of cockerels only be wanted, the male and female are known by examining the egg in the same way; such as have a "tread" or vacuum directly on the top of the egg will be a cockerel, and those on the side of the top, pullets. The hen should be provided with oats and water when hatching, with liberty to leave the eggs a little, if inclined. If she becomes affected with lice, &c., a little flour of brimstone may be shaken upon both her and the nest. As a hen brings forth the young of her own species in three weeks, or twenty-one days, she must be watched regularly to see if all goes on right, as sometimes the young require a little assistance to get out of the shell; this, however, is seldom necessary, and in nine cases out of ten it is better to let nature take its course; but the shell that the young have left ought to be instantly removed, as also any visible rotten eggs, which will make a watery jumble when shaken. A great deal of such trouble may be saved by being particular at the time of setting, when the eggs must be as equal in age as possible, and the newer laid the better, as such are more certain.

The difference in price of eggs at one period is so great as to make it advisable to keep them as fresh as possible; immediately when laid, rub them all over with fresh butter, then pack them into a cask in regular layers, with the round ends uppermost, and fill up all the vacancies with wood ashes—covering the layers about two inches deep with the ashes—they will come out as fresh six months after as when newly laid; or the crevices may be filled up with lime water: but must in this case be used immediately when taken from the cask. The crevices are sometimes filled up with the following mixture, viz.: To five quarts of cold water add one pound of salt and one ounce of saltpetre; boil together for about twenty-five minutes, and when nearly cold, add four table spoonsful of pounded quicklime; let it stand three days, stirring it twice a day. When a hen is fond of hatching, if not wanted for that purpose, I found a change of residence the best cure. Moulting, with its effects, generally lasts about two months, sometimes more, and if a hen is young, less. When chickens come first out, I feed for ten days with soaked oatmeal and hard boiled eggs, afterwards groats, hulled oats; all kinds of soft meat should be avoided at this age; but plenty of clean water, which should constantly stand before them, placed in such a manner that the chickens cannot get in to it. Fountains are now to be had anywhere, suitable for that purpose, or a bowl may be turned over in the middle of a pan of water. When rearing chickens never let them out too soon in the morning; avoid wet grass and rainy days, which generally bring on all diseases that gallinaceous poultry are subject to. It will be found that feeding poultry with the very best of oats is quite preferable. I have, on several occasions, had two birds from double-yoked Spanish eggs; some arrived at maturity and laid well, but the birds so produced are generally weak, and ill to rear; it is a system which ought not to be attempted, at least with a view of profit.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS.

CHIEF ENGINEER'S MONTHLY REPORT.

At the last ordinary monthly meeting of the executive committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, April 29th, 1862, Hugh Mason, Esq., Ashton-under-Lyne, Vice President, in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the last month there have been examined 363 engines and 563 boilers. Of the latter, 10 have been examined specially, 8 internally, 87 thoroughly, and 458 externally; in which the following defects have been found:—Fracture, 14 (3 dangerous); corrosion, 47 (5 dangerous); safety-valves out of order, 18 (1 dangerous); water gauges ditto, 8; pressure guages ditto, 8; blow-off cocks ditto, 33; fusible plugs ditto, 4; furnaces out of shape, 6 (3 dangerous): Total, 138 (12 dangerous). Boilers without glass water guages, 5; without pressure guages, 22; without blow-off cocks, 15; without back pressure valves, 2.

"I am happy to be able again to report that no explosion has occurred during the last month to any boiler under the inspection of this Association. Four explosions, however, which have happened in other quarters, have come to my knowledge, from three of which loss of life has resulted; one being of the most disastrously fatal character, no less than twenty-seven persons being killed.

"The latter of these explosions occurred at an iron works to a vertical boiler, heated by the flames from four iron furnaces. These flames first played upon the lower part of the outside of the boiler, and then passed through four openings in the side into an internal descending flue in the centre, and thence to the chimney. The boiler was cylindrical and egg-ended, and precisely similar in general arrangement to that first described in last month's report, being technically termed an upright furnace boiler. Its height had been about twenty-seven feet, and its diameter ten feet, while the thickness of the plates had varied in the original construction from five-sixteenths to seven-sixteenths. Its age was about nine years, and its working pressure, although stated by the engine attendant to have been 35 lbs., was concluded from an examination of the safety valves, &c., on an official inquiry at the instance of the coroner, to have been not less than 50 lbs.

"The injury done, however, in the present instance, was much greater than that resulting from the explosion of the boiler referred to in the last report. In that case, the crown of the internal descending flue was blown down, when the boiler shot upwards like a rocket, from unbalanced pressure. In the present case, the external shell in the lower part had rent, and an entire circumferential strip or belt ripped off, and scattered in several fragments. The main portion of the boiler, including the internal flue, had flown to a considerable height, being carried, as in the previous case, in the direction of the wind, falling completely beyond the boundary of the works, clearing the Great Western Railway, as well as a tramway, in its flight, and bedding itself so deeply in the ground as to exclude access through the rent at the bottom; the shell, as well as the internal flue, being considerably distorted by the shock on coming to the ground. The fragrants rent from the lower part of the shell had been blown laterally, sweeping down several of the columns of the building on which the roof depended for support, so that the whole became one general ruin. The brick-work flue surrounding the boiler, and which stood about fifteen feet above the ground, was scattered in every direction, just as the particles of a bomb-shell, and had riddled the roofs and windows of all the surrounding buildings. The percussive force of the steam had also destroyed the adjacent iron furnaces, and unseated, as well as denuded of its surrounding brick flue, a twin-vertical boiler, which had previously worked in conjunction with the one in question, being connected to it by a common steam-pipe. I note these facts, since, although unimportant in themselves, they show the destructive nature of the percussive action of steam, which should be taken into account in addition to the force of disruption and effect of unbalanced pressure, when attempting to unravel the complicated effects of explosions.

"There are grave objections to the construction of this boiler, as well as to the mode in which it was set. The intense flames from the furnaces by which it was heated, impinged most severely upon the lower part of the external shell, the diameter of which, being not less than ten feet, was of unusual size, while, in addition, the water was sedimentary. The combination of a high tensile strain upon the plate, which a large diameter—such as that in the present instance—involves, with an intense flame locally applied, added to an accumulation of deposit, is always dangerous, on account of liability to injury from overheating of the plates, and more especially of the seams of rivets; and it will be remembered that several explosions from this cause have lately been called attention to in these reports. Added to this, from the fact of the flame operating upon the bottom of a water-space, the circulation of the water was necessarily incomplete; and thus the risk increased of the rapid generation of the steam driving the water away from the plates. Many instances have occurred of plates being seriously overheated from this cause, even when the boiler contained a plentiful supply of water.

"It may be added that the boiler had been found so leaky a few weeks before the explosion, that a dose of bran had been resorted to, in order to stop it. Bran, while it stops the leaks, thickens the water, and prevents the globules of steam escaping freely, and thus would be most dangerous in a boiler already predisposed, as this one was by its construction and local impingment of the flame, to have the water driven away from the plates.

"Examination of the fragments, as well as of the seams of rivets in the twin boiler, confirmed the opinion that the plates had been weakened by overheating, and I consider the dangerous construction and setting of the boiler quite sufficient to account for the explosion. An accidental circumstance, such as a temporary increase of pressure, may have been the actual exciting cause in ultimately inducing explosion, but the conditions under which this boiler was working were such as, I am persuaded, no boiler can safely endure for any length of time; and since these conditions are not by any means confined to boilers of precisely similar construction, their consideration will be worth the attention of our members generally.

"After the two most serious explosions that have lately occurred, within a few weeks of one another, in the iron districts, *to* boilers of this description, and each attended with such fatal consequences, it will certainly be most reprehensible if another day is allowed to pass without having all similar boilers carefully examined, and their safety ascertained.

"Another life has been lost during the past month through the rupture of a Cornish boiler, which did not, however, result in an explosion. The flat-end plate had been allowed to *groove* at the furnace crown without repair, until it at last penetrated the entire thickness of the plate, when a rupture occurred, from which scalding, terminating fatally, ensued. The boiler, however, is reported not to have moved from its seat, which I have found to be the case under similar circumstances.

"The great difference between the result of a rent in a flat plate as above, and when occurring in a cylindrical shell as in the previous instance, will be at once seen. I have always found that those explosions which have resulted in the most serious consequences have been caused by rupture of the cylindrical portion of the shell, and hence its condition is a matter of the greatest importance; and it appears to me, therefore, desirable that it should be exempted from the injurious action of the fire to which boilers externally-fired are exposed."

A NEW STEAM GENERATOR.

TO THE EDITOR OF THE TIMES.

Sir,—The recent very awful boiler explosion at Priestfield, near Wolverhampton, at the ironworks, and where no less than 26 lives have been sacrificed, constrains me to take a course I otherwise would not have done so soon—namely, to publish a means of generating steam of a considerably greater elastic force than that produced in the ordinary boilers, even at the highest possible pressure that can be arrived at by building these boilers ever so strong. Now, a pressure of even as much as 500lb. per square inch may be raised in this apparatus that I am desirous of introducing to your notice, and while at that pressure, if an explosion were to occur, not the slightest danger to life need be apprehended by any one standing beside or sitting upon it, as there is no boiler. I can naturally suppose you will say this is a startling assertion, that steam can be raised without a boiler. Therefore, if you will allow me, I will endeavour to explain the matter to you. I have an apparatus of between 3 and 4-horse power now at work, giving every possible satisfaction, and I may add, without at all being an egotist, that the results we have had from it are truly wonderful for quick generation, great power, large saving of fuel, and perfect control, being entirely free from danger; and the space it occupies is only equal to about four cubic feet. Now, although I am only using this for about 3-horse power, its capacity is quite sufficient for 10-horse.

But to describe the principal,—as steam is required to be generated, I cause a very small quantity of cold water to be injected into a metal pipe of small bore, and which passes in a serpentine figure through the furnace, and above the intense heat of the ignited fuel. This furnace is for the purpose of heating the generator, which is a cylindrical chamber, containing about 3,000 cubic inches of space, the small serpentine feed-pipe always being quite hot, or sufficiently so that as soon as the water, which is not more than a quarter of a cubic inch at each successive stroke, is squirted into it by means of a small force pump, it immediately flashes into steam, when, after rapidly travelling through this pipe, of course surcharging all the time, it passes through an induction valve into another serpentine pipe of the same dimensions as the first; this is laid in, and on the bottom of, the generator. Now this pipe eventually terminates in a large rose-head (like the top of a garden watering pot), that distributes the steam into the generating chamber for the purpose of surcharging it to any extent of expansion, consequent upon the amount of heat applied. The generating chamber is so formed and fixed that the whole surface is entirely exposed to the heat of the fire and to the heated products of combustion passing therefrom; and the generator never at any time contains any water or anything in a liquid state, for directly the water (being such a small quantity) is forced into the hot serpentine feed-pipe conversion takes place. It is therefore an instantaneous generation and surcharging of steam, so long as the necessary heat is kept up, and which is a saving in fuel of 60 or 70 per cent. in comparison with the ordinary boiler's consumption.

Now I think you may easily perceive by the above description that unless water is pumped in no power can be gained. For example, say I have not a particle of steam in the generating chamber; the heat of course being applied (by the fire having been previously lighted), I will now force in one cubic inch of water by the means and through the channel I have previously shown, when it immediately—yes, in one second, expands (by passing over such an immense amount of heating surface) into the enormous quantity of 50,000 times its original liquid volume, and upon this one inch of water the engines are put in motion and the self-acting feed commences; and, although the steam is quite invisible when escaping from the safety valve, still it is (unlike the hitherto superheated steam) beautifully humid and cool, the engines that are worked by it requiring no lubrication beyond a small drop of oil to the cylinders, and the common hemp and tallow is all that is necessary to be used as a packing for piston and slide glands.

By my foregoing statement I think it will be clear to our scientific engineers that no danger can result from an explosion, as there is no volume of water from which power is procured. Consequently, if it actually should explode by undue pressure, so soon as a vent is given it will be all gone, being so very fine. In fact, I have had a practical illustration of this at 48lb. pressure to the square inch, and I did not experience the slightest inconvenience, even when I was holding down the lever of the safety valve at the time; but, of course, the power was soon gone, through a rent made of more than five inches long; and, if I may be allowed the comparison, it had no greater effect than blowing a large paper bag full of atmospheric air, and then by a sharp blow bursting it. Nothing was to be seen. Really, I could not imagine that the generator, of cast iron, three-quarters of an inch thick, containing more than a cubic foot of space, at a pressure of 48lb. to the inch, had gone, until after a careful examination, upon finding my engine stop, consequent upon the power getting away faster than generation, and with a tremendous roaring noise—for that was the only indication I had, as I could see nothing.

And now, Sir, I will not attempt to intrude longer upon you, but give a free invitation to all our leading practical engineers, to favour me with a visit as early as possible (begging I may be previously notified of their coming) to the Royal Small-arms Factory, Enfield, when I shall be most happy to render every information by explaining with drawings, &c., and exhibiting the apparatus at work. This achievement is the result of 18 months' hard labour; and, as boiler explosions do not appear on the decline, but on the contrary, and attended with more awful consequences, it is now quite time something should be done to remedy the evil. I have therefore presumed to submit this to you, with an earnest desire that our engineers should read it in your columns, and am,

Sir, yours truly and obliged,

CHAS. F. HAYES, Engineer,
Superintendent, Lock and Screw Departments.

Royal Small-arms Factory, April 24.

TO CORRESPONDENTS.

Received.—S. T. and Co., F. Y., G. W., W. R. M., M. M., J. B., Wilba, R. M., J. S. jun., J. A. S., J. P., R. T., W. H. P., J. D., Col. S., W. H., Engineer, W. R. M., J. J., Amateur, J. H. G., B. M., G. P., W. A., H. J. P., R. M. L.

Several letters, &c., are unavoidably postponed till our next issue.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

INSTITUTION OF NAVAL ARCHITECTS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—There is much truth in what a "Thirty years' Subscriber" says in his letter inserted in No. 173; the difficulty would, however, be great to obtain the attendance of a number of gentlemen for one day in each week, unless they were to be well remunerated for their services, for I think they would have hard work of it to get through in one day the plans that would be weekly laid before them, 96 per cent. of which would be mere waste paper.

I think it would be a much better plan for each inventor to lay his scheme before some gentleman who has paid particular attention to the mechanical problem which the invention is intended to solve, paying him a fee for his trouble, and, if he endorses it with his approval, it might then be forwarded to the Admiralty. By adopting this mode of procedure, the Admiralty would be relieved of the great trouble of wading through a mass of rubbish, and really good propositions would come before them, coupled with the names of men which would soon become familiar to them, and would add weight to the arguments accompanying the invention.

I am, Sir,
Your very obedient servant,
T. MOY.

April 26, 1862.

◆

THE HARTLEY BEAM.

SIR,—A correspondent who signs himself "Founder" states for the information of the public, and for mine in particular, "that the Hartley beam was a dry sand mould covered with loam plates, &c., and not an open sand casting." I am very glad that any remarks that I may have made have elicited the truth, for such was the vague manner in which the statements were made at the inquest, that it is the general belief, that it was an open sand casting, and it has not, to my knowledge, been publicly stated to have been otherwise, until your correspondent came forth at the eleventh hour to enlighten us upon the matter. And although such is the case, it still makes my argument good, that we do not possess sufficient knowledge to produce castings of such a high order as is requisite, notwithstanding they did all they could to produce one of the first class description. With all the heads for the supply of crystalization, they did not produce thorough homogenity in the centre bosses.

And as to the proper distribution of the metal, in the opinion of one of the Government inspectors, a similar beam has been condemned as not fit for such purposes.

Yours &c.,
JOHN M. OVERIDGE.

Engine Works, Grosvenor Road, Pimlico, S. W.
April 30th, 1862.

◆

THE MESSINA STEEL BRIDGE.

SIR.—In my last week's notice of this bridge, I omitted to state that the order for the steel plates for this bridge, was handed to us by Mr. John Box, of Katesgrove, Reading. Mr. Box, with his son-in-law, Mr. Straight, frequently receives very extensive foreign orders for execution in this country, and this order was one of the number.

ROBERT MUSHET.

Coleford, April 29th, 1862.

◆

SUBMARINE EXPLOSIVES.

SIR,—As submarine explosives are likely to be employed in the destruction of iron-cased ships, I beg to inform the public, through your journal, that this day I witnessed a successful experiment on that principle, by Capt. J. Norton, late 34th Regt., in a lake at the archery grounds, Monkstown, before several scientific persons.

J. WHITLEY, H. P., Capt. 9th Foot.

Kingstown, April 28th, 1862.

The *Philadelphia Bulletin* says:—The Lincoln gun, on the Rip Raps, has been mounted and tried in order to test the carriage on which it is placed. Only ten shots were fired. The second was a splendid ricochet shot. The immense ball, weighing 437 pounds, after making three plunges and renewed flights, finally sunk away off near Sewall's Point. If the Merrimac could stand one of these Lincoln pills, as they are called here, she is proof against all the appliances of modern gunnery.

Gossip.

The estimated cost of the Thames Embankment, including compensation and other expenses, is £1,500,000. The estimated cost of the street to the Mansion House is £500,000, and the other approaches £80,000. The length of the embankment will be 2,235 yards.

The lattice-work girder bridge, intended to supersede Brunel's suspension footway across the Thames at Hungerford is rapidly advancing, and in anticipation of its speedy completion, the buildings connected with and adjoining the market are being demolished. The usual thoroughfare to the "penny steamboats" is closed, and another has been formed through Villiers-street, Strand. The new bridge will be an elegant addition to the aquatic architecture of London, and seen from the river it will have a singularly light appearance. Few will regret the disappearance of the "great hall," and other appurtenances of Hungerford, for they were, after nightfall, a harbour for all the idle boys and girls of the neighbourhood, whose language and conduct were anything but what could be wished. The station of the Chatham and Dover Railway, which will supplant the market, will be commodious and handsome.

A large and influential meeting of the general reception committee of the Social Science Association was held in the Mansion-house on Tuesday last, the Lord Mayor in the chair. A report was presented by the finance committee stating the arrangements that have been made up to the present time. Papers on a variety of interesting subjects connected with the different departments of the association have been promised by gentlemen intimately acquainted with the various questions which it is proposed to discuss. A series of interesting soirees will be given during the time of the meeting, and it is intended to provide for visits to places and institutions illustrative of the objects of the association. A large attendance of distinguished foreigners is expected. A fund is now being raised for the purpose of meeting the necessary expenses, and a Foreign Reception and Corresponding Committee has been appointed.

A preliminary meeting of inventors and others interested in patent property was yesterday held at 26 Great George-street, Westminster, and an association called the "Inventors' Institute" was formed for the following objects, viz.:—"To unite and organise the influence of inventors and patentees. To facilitate the progress of science in connection with inventions. To obtain a simple and efficient administration of the patent laws, and generally to protect the rights and promote the interests of inventors." It was determined that the subscription of an annual member should be one guinea, and that the payment for becoming a life member should be ten guineas. A provisional committee was appointed, of which Mr. Robert Richardson, C.E., of 26 Great George-street, Westminster, was elected the chairman, and arrangements were made for shortly convening a public meeting to further the interests of the Institute.

From some cause or another, the Burdett Coutts drinking fountain, in course of erection in the Victoria Park, does not advance towards completion with such speed as might be desired. Fully eighteen months have elapsed since the munificent sum of £5,000 was given by the lady whose name we have associated with the fountain, for the purpose of effecting its erection. As yet, however, it has not been opened for public service. Messrs. Smith & Co., the celebrated contractors of Pimlico, undertook the execution of the work; but somehow their arrangements respecting its construction seem to "hang fire." This is the more to be regretted since there is no locality in London where such an adjunct is so much needed. The Victoria Park is frequented by thousands of the hard working inhabitants of the east end, of both sexes, and a copious supply of pure water throughout the hot months of summer would be a boon thoroughly appreciated by them. Of the design of the fountain we may speak in the highest terms. It is in every way adapted for its purpose, and will form a handsome addition to the existing beauties of the eastern public pleasure ground. The structure is of an octagonal and temple-like form, of lofty elevation. The roof, which is covered with sheet copper, is supported by eight columns of polished Peterhead granite. Within four alternate niches, facing the cardinal points, are placed groups of marble statuary, and from each of these, by aid of appropriate urns, the "crystal streams" are intended to flow. This quadruple fountain, as it may be ter[illegible] in the centre of the park, and it will [illegible] y ornamental v[illegible] at fo[illegible] which will [illegible] ayf where their thirst may be slaked. From the surface of the moat to the summit of the edifice, is nearly fifty feet, and the whole will certainly form, as we have said, an ornamental and useful appendage to Victoria Park, while it will be, at the same time, a lasting memorial of the enlightened beneficence of its founder. Its tardy completion is all that is to be regretted; but perhaps the Messrs. Smith will now put their shoulders to the wheel, and so remove the cause of regret. The east end of London should not be neglected, while so much is being done for the advantage of more fashionable dwellers in the west end of the great city.

Mr. R. Mushet in a letter says: Mr. Martien and myself ought to feel grateful for the prominent notice into which Mr. Bessemer is so kindly bringing our inventions, at the Great Exhibition, and I venture to suggest that on the "Trophy" there shall be conspicuously written as under, "Martien and Mushet. Illustrated by H. Bessemer."

The *Times* says the 300-pounder Armstrong gun was yesterday proved at Shoeburyness as a smooth bore. The proof consisted of four rounds—the first with 60lb. of powder, the second with 70lb., the third with 80lb., and the fourth with 90lb. After the proof further experiments were carried on with the same gun to ascertain the initial velocities obtained with large charges of different kinds of powder.

The manufacture of steel pens is now extensively carried on in France, though the material used therein is imported almost exclusively from Sheffield. At one establishment at Boulogne, that of Messrs. Blanzy, Pore, and Co., no less than 45,000 gross of steel pens are turned out weekly, in addition to something like eight tons of crinoline. The manufacture of this latter resembles, to a certain extent, that of steel for steel pens, and hence the combination of the two branches of industry. Messrs. Blanzy and Co. employ in the whole 600 hands, the majority of whom are females. The superintendents of the various branches of this extensive steel manufactory are, however, without exception, Englishmen. There is no doubt that the comparative cheapness of labour in France, as compared with its price in England, contributes to make the French steel pen manufacturer a formidable rival to the English producer of those indispensable articles. Still, there seems to be "room enough for all," as the demand for pens hourly increases.

The *United Service Gazette* says Mr. Allam, of Rhode Island, for whom the United States Government have instituted an office, with the title of "Aeronautic Engineer," has, it appears, made a successful attempt to communicate with the earth from a balloon, by means of the electric wire. The first despatch was sent from "above Washington," and the professor describes himself as having been able to take observations over a diameter of fifty miles.

In this district (says the *Stamford Mercury*) unemployed young labourers and itinerants are turning their attention to a new mode of obtaining a livelihood. Some of these men have appeared the last two or three market days at Spalding and Holbeach with hundreds of linnets, finches, sparrows, and other small birds (which they have poisoned), strung round them like beads, as trophies, and an advertisement of their odious calling. Leaving out of the question the fact ascertained by the scientific researches of nearly all the civilized countries of the world, that this mode of interfering with the balance of creation is followed by worse and unconquerable evils in the shape of insects, is it not a matter for serious consideration that the safety of the community should be jeopardized by such a system? The poison used for the purpose are the instruments with which revenge or malignity often accomplish its detestable purpose—*i. e.*, arsenic, strychnine, and phosphorus.

The *Commercial Bulletin*, U. S., states that the manufacture of files by Whipple's patent machines is successfully carried on at Ballard Vale, about twenty miles from Boston. The factory is a stone building 276 feet long, 45 feet wide and three stories high. The machinery is driven by two powerful steam engines. The steel for the files is cut off the right length by shears. The best quality of cast steel is used, which, after being cut, goes to the forging shop, where, under nicely gaged trip hammers, the file blanks are forged. From here they go to the annealing furnace, where they are partially decarbonized. After this they are straightened and carried to the grinding room, where they are ground perfectly level, and are then ready to be placed in the cutting machines. Eight files are placed in each machine, where by the use of revolving cutters, the burs are cut. After cutting, and before hardening, each file is stamped by machinery with the name of the company. They then go to the hardening department and are overlaid with a paste of salt and flour which protects the teeth when heated. The skillful hardener, who is devoted exclusively to this, dips the file into the "lead bath," which heats it to allow red heat, when it is immersed in salt water, and before it is cold it is straightened, if sprung in the process. The paste is then brushed out and the files are put into lime water, remaining twenty-four hours, then taken out, dried and brushed; they are then oiled, which preserves them from rust. Every file is tested by an expert by ringing it upon an anvil, and his accustomed ear detects any flaw. The least irregularity in cutting is rejected. The most perfect system is observed throughout these works, where about 120 men and boys are employed.

Iron Street Paving.—On Tuesday evening the Poultry was reopened, after having been closed for a week for repaving. The new pavement, which is a modification of Knapp's patent, consists of heavy cast iron sections, hollow and hexagonal in form, locking together at their junctions, and presenting numerous small projections over their upper face. These sections are solidly bedded and filled to the surface level with ballast, well rammed, and next to the kerbs the blocks abut against Redman's cast-iron trams. Greatly increased durability, together with sure footing, is expected to be gained by this mode of paving, the granite being found unable to withstand for any length of time the immense traffic passing over this short length of street. An adjoining portion has been laid with granite paving, in combination with Carey's cast-iron wheel track. In this invention the side towards the centre of the roadway is notched at intervals to admit the ends of the granite sets, the other side abutting upon the iron drawing kerb, and thus is obtained a good track for the near wheels of carriages and a channel for the surface drainage. These works will afford a favourable opportunity for comparing the respective capabilities of iron and granite paving in one of the most crowded streets of the metropolis. The work has been done, under the direction of Mr. William Haywood, the engineer to the Commissioners of Sewers, by Messrs. Crook and Son and Messrs. Ransome, of Ipswich.—The *Times*.

Steam Shipbuilding on the Clyde.—Messrs. Burns have contracted with Messrs. R. Napier and Co. for a paddle to be placed on their line between Glasgow and Belfast. Messrs. J. and G. Thomson have launched at Govan a screw named the Clydesdale, owned by Messrs. David Hutcheson and Co., of Glasgow, and intended for the West Highland trade. The Clydesdale is 500 tons' burden, builder's measurement, and will be fitted with engines of 110-horse power on the inverted cylinder principle, with surface condensers and other recent improvements. Messrs. W. Denny and Brothers, of Dumbarton, are laying down two screws of 600 tons each, for Mr. Walter MacFarlane, who proposes to employ them in trading on the Chinese coasts. Messrs. Denny and Co. will supply each vessel with engines of 100-horse power nominal. The Lotus, screw, recently launched from the yard of Messrs. Henderson, Coulburn, and Co., of Renfrew, has made a satisfactory trial trip. The Lotus, which will carry 700 tons with 10ft. fore and aft of water, is also intended for the China trade. She is propelled by a pair of inverted diagonal oscillating engines, and attained on the trial trip an average speed of 13½ miles an hour. She is 210ft. long, 27ft. breadth of beam, and 16ft. deep.

Railway Travelling.—The number of travellers by railway in the United Kingdom in 1861 was 163,435,678, besides 49,894 holders of season and periodical tickets, who must have made very many journeys; in the whole there must have been much nearer six than five journeys in the year for every soul in the kingdom. The trains, passenger and goods trains together, travelled 102,243,602 miles, which is further than going 4,000 times round the world; 267,124 horses and 357,474 dogs made railway journeys, little to their liking. The goods traffic comprised 12,083,503 cattle, sheep, and pigs, and 89,857,719 tons of minerals and general merchandise. In these vast piles of property conveyed from place to place the minerals double the general merchandise in quantity, and they are carried at little more than a quarter of the cost; 60,386,788 tons of minerals produced to the railway companies only £4,951,899; while 29,470,931 tons of general merchandise brought them £9,157,987. The receipts of the railways (10,433 miles in length at the close of the year) from all sources of traffic were £27,766,622., of which £13,085,756 came from passenger traffic and the mails, and residue from goods. The expenditure was £13,187,368, or 47 per cent., leaving rather more than £14,500,000 net receipts. The compensation paid for accidents and losses amounted to £181,170. The quantity of rolling stock was no less than 5,801 locomotives, 15,070 passenger carriages, and 180,574 waggons for goods traffic; in all 201,451 engines and carriages. The numbers are enormous, and they are enormously increasing. Comparing last year with the year before, notwithstanding the bad weather, the passengers increased by 13,600,000, the minerals by 8,600,000 tons, the receipts by above £2,000,000, the miles travelled by trains nearly 9,000,000. 3,896,960 trains ran in the course of the year 1860; upwards of 10,000 a-day.—*Express.*

Measurement of the Earth.—"Lieutenant-General Bayer," says the *Kreutz Zeitung* of Berlin, "who has rendered a great service to science in executing, in concert with the astronomer Bessel, the survey of Prussia, has lately proposed a new trigonometrical operation for ascertaining the exact size and form of the earth. It would be necessary to measure exactly a section comprised between the parallels of Palermo and Christiana, on the one hand, and the meridians of Kœnigsberg and Bonn, on the other. This proposition has been approved of by the Prussian Government, which has invited the states comprised in the section to participate in the work. Conferences will be opened in a few days between the delegates of the States which have given their consent. Austria will be represented by General de Fligely, M. de Littrow, and Professor Herr."

A Great Telescope.—Mr. Alvan Clark, of Cambridge, Mass., has constructed an achromatic telescope, said to be the largest in the world. The glass has a focal distance of 23 feet, and a diameter of 18 inches. The glass revolves the sextuple star Thera, one Orionis, which is regarded as a severe test. Mr. Tuttle, of the Boston Society of Natural History, tells what further has been disclosed by it:—"The telescope was then directed to the bright star Sirius, the most brilliant star in the whole heavens, and popularly known as the 'Dog Star.' All eyes eagerly sought for the minute companion star which Mr. Clark had discovered on the previous Friday evening, on the occasion of his first directing the telescope to that star. It required but little time for those accustomed to look at minute telescopic objects to discern the little stranger hovering close within the dazzling rays of the brilliant Sirius, and almost exactly following it in right ascension. Its minute, tremulous light, when once caught by the eye, was easily kept in view, and as the star ascended in altitude, became still better seen. In point of brilliancy, it does not differ greatly from the well-known 'sixth star in the trapezium' of Orion." This telescope has removed both difficulties of spherical and chromatic aberration, and shows the images of the stars as round, uniform discs, without any wings or wisps of light distorting their aspect. Since the discovery of the companion of Sirius by Mr. Clark, Professor Bond, of the Harvard Observatory, has seen it with his refractory telescope. He says:—"The low altitude of Sirius in this latitude, even when on the Meridian, makes it very difficult to catch sight of the companion, on account of atmospheric disturbances; when the images are tranquil, however, it is readily seen. It must be regarded as the best possible evidence of the superior quality of the object-glass that it has served to discover this minute star so close to the overpowering brilliancy of Sirius. A defect in the material or workmanship would be very sure to cause a dispersion of light, which would be fatal to its visibility. It remains to be seen whether this will prove to be the hitherto invisible body long disturbing the motions of Sirius, the existence of which has long been surmised from the investigations of Bessel and Peters upon the irregularities of its proper motion in right ascension."—*American paper.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c. 2536, 2537, 2543, 2558, 2567, 2569, 2589.

Boilers and their Furnaces, &c., 2502, 2551, 2555.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2538, 2541, 2568, 2571, 2513, 2517.

Ships and Boats, including their fittings, 2570, 2584.

Cultivation of the Soil, including agricultural and horticultural implements and machines, 2516, 2582, 2594.

Food and Beverages, including apparatus for preparing food for men and animals, 2525, 2556.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2506, 2507, 2528, 2530, 2547, 2548, 2550, 2557, 2562, 2566, 2573, 2585, 2587.

Digitized by Google

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 2509, 2518, 2534, 2554.
Lighting, Heating, and Ventilating, 2504, 2512, 2516. 2523, 2580, 2590, 2591.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2508, 2520, 2532, 2544, 2548, 2556, 2559, 2561, 2564, 2572, 2592, 2595, 2596.
Metals, including apparatus for their manufacture, 2521.
Chemistry and Photography, 2540, 2553.
Electrical Apparatus, 2545, 2597.
Warfare, 2514, 2522, 2533, 2546, 2563, 2577, 2581, 2593, 2501.
Letter-Press Printing, &c., 2531, 2565, 2511.
Miscellaneous, 2503, 2505, 2515, 2519, 2524, 2529, 2552, 2560, 2574, 2575, 2578, 2579, 2584, 2586.

2501. W. Kriller. *Improvements in signalling for rifle practice.* Dated Oct. 7, 1861.

This consists of a ball or disc made to move from place to place on the target, or on a signal board erected for the purpose, so as to indicate to the shooting party the precise point of the target which the ball has struck. *Patent abandoned.*

2502. G. K. Stothert. *Improvements in condensing apparatus.* Dated Oct. 7, 1861.

Here the patentee constructs a condenser in a cylindrical form, the cylinder being somewhat longer than the tubes contained therein. The two ends of the cylinder are made with flanges, and external of the cylinder is a pocket or casing, extending nearly the whole length of the cylinder, leaving a water space between the external surface of the cylinder and the interior of the pocket, which water space communicates with the interior of the cylinder by openings near the two ends of it, and the other is arranged to slide within the cylinder near its other end, a gland or ring and packing being used to keep the same steam and water tight. *Patent completed.*

2503. J. E. J. Sansum. *Improved machinery for mashing malt.* Dated Oct. 7, 1861.

The object here is to arrange the mixing implement or instrument, so that it may always act on the surface of the liquor, or but little below the same, whereby the admixture or combination of the meal with the liquor, as the former is gradually poured in, will be more perfectly and speedily effected. *Patent abandoned.*

2504. F. J. Evans. *Improved apparatus for generating gas.* Dated Oct. 7, 1861.

Here the patentee uses a vertical retort of large capacity and peculiar construction enclosed within a furnace or oven, and surrounded by a heating flue, which leads from the fire-place, and rises spirally around the retort until it reaches the exit opening to the chimney. The invention is not described apart from the drawings. *Patent completed.*

2505. J. C. Willsher. *Improvements in the construction of combined thrashing and dressing machines.* Dated Oct. 7, 1861.

The object here is to simplify the construction of thrashing machines, and consists in connecting the screens or riddles with the shaker bars in such manner that the requisite motions for the screens or riddles will be communicated through the shaker bars. *Patent completed.*

2506. A. Ford. *An improved method of waterproofing.* Dated Oct. 8, 1861.

The patentee claims the formation of compound waterproof fabrics, consisting partly of woven or spun fabrics, and partly of paper, the paper alone being directly coated with a waterproofing agent, and its combination with other substances being effected subsequently. *Patent completed.*

2507. W. Catford and J. S. Wheatley. *Improvements in the manufacture of bobbin net or twist lace.* Dated Oct. 8, 1861.

This relates to that description of net known as "traverse net," in which the bobbin threads in making the ground of the fabric are capable of traversing from selvage to selvage, and the invention consists in introducing ornamenting threads, which are so governed as to twist or plait with the bobbin threads of the upper set of carriages, thus forming part of the groundwork of the fabric when they are not working to produce figuring or ornamental work thereon. *Patent completed.*

2508. H. Willis. *Improvements in the construction of organs.* Dated Oct. 8, 1861.

This relates, 1, to means for overcoming the resistance caused by the pressure of the air upon the valves of the organ, and for reducing the noise occasioned by their closing, the object being at the same time to retain the simplicity of action of the ordinary valve. 2. To means for operating the "swell," the object being to enable the performer to obtain with facility a crescendo and diminuendo when his feet are already fully employed on the pedals. To this end the patentee provides a mouthpiece attached to a flexible tube leading to a pneumatic apparatus in connection with the organ swell, and he so arranges the pneumatic apparatus that the performer by blowing into the tube will be enabled to set in motion and cause it to open the shutters of the swell to any required extent. The invention is not described in detail apart from the drawings. *Patent completed.*

2509. G. Glover. *Improvements in constructing fire-proof doors and window shutters.* Dated Oct. 8, 1861.

In constructing fire-proof doors the inventor forms them of fire clay moulded to the required form, with or without a lattice of hoop iron in the middle of the thickness. The doors are arranged to hang on pivots and caps, and the pivots are to be moulded on and form part of the door, and are to be tipped with gun metal; the cap is to be of the same material, and the fasteners are also to be of fire clay. The doors are to be arranged to close against plugs of india-rubber or felt, so as to prevent undue concussion. Doors for trapways may also be made in the same manner. *Patent abandoned.*

2511. S. Bremner. *Improvements in the construction of printing machines, and in driving or actuating the same.* Dated Oct. 8, 1861.

This consists, 1, in a peculiar construction and arrangement of single cylinder printing machines, whereby they are rendered more certain and effective in action, and are more compact than the same class of machines hitherto used. 2. In an improved mode of driving or actuating printing machines. *Patent completed.*

2512. J. Evans, jun. *An improved miners' lamp.* Dated Oct. 8, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2513. J. E. Grisdale. *Improvements in certain tickets or passes for railway and other purposes.* Dated Oct. 8, 1861.

This consists in applying to a conspicuous part of the said tickets or passes a photographic portrait of the person to whom the same is issued. *Patent abandoned.*

2514. R. W. Sievier. *Improvements in batteries for the purposes of war.* Dated Oct. 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2515. J. Baggs and J. T. Parks. *Certain improvements in the manufacture and treatment of india-rubber and vulcanite, as applied to various purposes.* Dated Oct. 9, 1861.

One portion of this invention relates to the colouring of india-rubber and vulcanite, and is effected by incorporating or combining coloured glass, pipe clay, and other suitable colouring substances or agents, with india-rubber or vulcanite. The details of the invention are voluminous. *Patent abandoned.*

2516. W. Smith. *Improvements in apparatus for measuring and regulating the pressure of gas.* Dated Oct. 9, 1861.

This relates, 1, to that kind of meter termed a consumers' compensating meter, and consists in the mode of constructing the lead pipe. Also in a method of construction, whereby gas cannot be obtained when the meter is tilted. Also in means for regulating the throw of the diaphragm. Also the invention comprises improvements in single light governors, and in indexes of all kinds of meters. *Patent completed.*

2517. E. Haslawood. *Improvements in apparatus for preventing or loosening the slip of the driving wheels of locomotive engines.* (A communication.) Dated Oct. 9, 1861.

This invention has reference to an electric helix, and consists in constructing such apparatus with the helix or coil covered in respect of the appearance it would present in side view when applied to a wheel, so that the lower portion of the curve might be disposed at or in proximity to the lowest portion of the wheel, whereby an increased magnetic effect is obtained. There are other features included. *Patent abandoned.*

2518. J. Walker. *An improved chimney top, cap, or cowl, for the prevention of the descent of sooty exhalations, curing of smoky chimneys, and ventilation of apartments.* Dated Oct. 9, 1861.

This consists, 1, in the construction of pots, cowls, or wind guards, full of small holes or slits, so that the wind has its force broken up, and is minutely sub-divided, so that, in mixing with the air within the pot, it accelerates the expulsion of the same. 2. To prevent downward draughts, and to facilitate the expulsion of the smoke, the inventor adds to the above pot an elastic top, which bends over with the force of the wind, and re-adjusts itself when the wind ceases, which constant motion also prevents the soot being deposited. *Patent abandoned.*

2519. J. Norman. *Improvements in hammers to be worked by steam or other elastic fluid, and in anvils for the same.* Dated Oct. 9, 1861.

This consists, 1, in making the piston-chamber in two or more longitudinal parts, and square in cross section, or of other convenient form, which will prevent the turning of the piston or plunger, and so dispense with separate guides. The improvements in anvils comprise several modifications, in all of which the anvil is adjustable, so that different creases may with facility be brought under the hammer. *Patent completed.*

2520. G. Davies. *Improvements in machinery for manufacturing shoes for horses and other animals.* (A communication.) Dated Oct. 9, 1861.

We cannot here give space to the details of this invention. *Patent completed.*

2521. H. B. Coathupe. *Improvements in obtaining or producing and applying embossed or raised and engraved or indented metal or other surfaces.* Dated Oct. 9, 1861.

The chief feature of this invention consists in taking a mould in plaster, paper, sulphur, glass, metal, gutta-percha, wax, starch, gum, from the ordinary printing types or lines, or designs, drawn or executed in copper, steel, wood, or other surfaces; which mould is then to be scraped and smoothed down to the finer lines, thereby leaving an indented impression on the mould, reading the ordinary way, from left to right; then from the mould produced, a second mould is to be taken in plaster of paris, or papier maché, which will then bear the same letters, lines, or designs raised, but backwards; a cast in metal is then to be taken from it, and an indented plate will be produced precisely similar to those produced by the tedious process of engraving; this is to be filled in with coloured or plain inks, pitch, sealing wax, &c., the plate being faced by friction. *Patent completed.*

2522. F. Curtis. *A new and useful improvement in fire-arms.* Dated Oct. 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2523. W. Palmer. *Improvements in lamps and lamp wicks.* Dated Oct. 9, 1861.

Here the wick tubes are so constructed that the wicks pass out in a lateral direction, two wick tubes or pipes being used. *Patent completed.*

2524. J. J. Russell. *Improvements in hand stocks and dies for cutting screws.* Dated Oct. 9, 1861.

Here, in constructing hand stocks and screw dies to be used therewith, the central part of the stock is made with a circular opening or recess of suitable dimensions to receive a die, which, in place of being made in two pieces, is made of a single piece, and of a circular or cylindrical form; the die is retained within the recess or opening in the stock by means of the projecting heads of two screws screwed into the stock at opposite points of the diameter of the die. The die is of steel, and is made with cutting edges projecting inwards at four points, at equal distances apart, on the inner circumference of the die, and these cutting edges are made, by preference, somewhat bell-mouthed where they first begin to cut or tap the end of a tube or rod. A die thus formed will admit of being again and again reformed after it is worn away and blunted, by simply softening it and hammering its exterior opposite where two sets of the projecting cutters are situated, so as to force such opposite cutters towards the centre of the die, and then hammering it opposite where the other two sets of cutters are situated, so as to drive those cutters also towards the centre. The die is then to be made complete by screwing in the proper screw-tap, and by again tempering the die. *Patent completed.*

2525. Thomas Tidmarsh. *An improved artificial manure.* Dated Oct. 9, 1861.

Here the patentee collects such matters as peat, turf, twitch, stubble, bone, skin, &c., and by heat reduces them to an alkaline ash. To these he adds, in certain proportions, human night soil, quick lime, animal urine, farm yard liquor, and vitrol. *Patent completed.*

2528. T. P. Bennett and James Collier. *Certain improvements in or applicable to self-acting mules for spinning.* Dated Oct. 10, 1861.

This consists in arrangements of parts for regulating the rise of the faller when released from the sector, or other apparatus by which it is held during the running in of the carriage, the object being to wind the slack yarn on to the spindles when the carriage is near the roller beam, and thus to prevent snarls. This invention is not described apart from the drawings. *Patent completed.*

2529. D. S. Brown. *Certain improvements in propelling and sustaining balloons and aerial machines in the air.* Dated Oct. 10, 1861.

This consists in the use of ammonia and carbonic acid to work engines similar to steam engines, for giving motion to fans like screw propellers; with a view of propelling and sustaining balloons and aerial machines in the air. *Patent abandoned.*

2530. W. Mould, John Hall, Samuel Cook, and W. H. Hacking. *Improvements in machinery for manufacturing healds or harness used in looms for weaving.* Dated Oct. 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2531. C. W. Felt. *An improved machine for setting, spacing, justifying, and distributing printers' type.* Dated Oct. 10, 1861.

We cannot here devote space to the voluminous details of this invention. *Patent completed.*

2532. J. Stevens. *Certain improvements in connectors and adjusters for connecting and adjusting crinolines.* Dated Oct. 10, 1861.

These connectors and adjusters are made from sheet metal, and act as clips or springs. *Patent abandoned.*

2534. B. Browne. *A new improved spring.* (A communication.) Dated Oct. 10, 1861.

This consists of combination of steel blades or strips of tempered steel, bent in different curves or directions, the said blades being connected together at their extremities, so as to act one upon the other, so that when in use the end portions of the blades pressing upon each other stiffens the springs, and thus adapts them to the load or pressure they are required to bear or carry. *Patent completed.*

2536. W. E. Newton. *Improvements in heating the feed water of steam engines.* (A communication.) Dated Oct. 10, 1861.

This consists in withdrawing a portion of the steam from the induction side of the piston by means of additional eduction valves, after the passage of the steam from the boiler to the cylinder has been intercepted, but before the end of the stroke of the piston, and before the eduction valve begins to open; by means of the steam thus withdrawn, the feed water is heated in a vessel closed against the atmosphere. *Patent completed.*

2537. W. Payne, and J. Burgum. *Improved packing for engines and machinery.* Dated Oct. 10, 1861.

This improved packing is formed of small particles of sponge, combined with grease and a metallic powder. *Patent abandoned.*

2538. W. Clark. *Improvements in apparatus for bending iron rails or bars.* (A communication.) Dated Oct. 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2540. C. N. Kernot and M. D. Rucker. *Improvements in the method of obtaining ammoniacal salts and other valuable products from liquors or substances containing ammonia, and for utilising the residuum.* Dated Oct. 11, 1861.

The patentee claims the precipitation of ammonia, and obtaining its salts and other valuable products from solutions or substances containing ammonia, by sulphate of zinc or other sulphates, and by solutions prepared from bones and other phosphites of lime, coprolites, apatite, phosphorite, or other mineral phosphates, with hydrochloric, sulphuric, or other acids, as described. *Patent completed.*

2541. R. Richardson. *Improvements in the manufacture of railway fastenings, and a mode of preparing rails and fish plates to receive them.* Dated Oct. 11, 1861.

This consists in manufacturing railway fastenings by rolling them into shape, and cutting them without the aid of a second heating; and also in an improved manner of preparing rails and fish plates to receive the said spikes, bolts, and screws, which consists in punching the holes of the rails and fish plates in a conical shape, with any number of sides not less than three. *Patent abandoned.*

2542. T. B. Collingwood and A. Butterworth. *Im-*

provements in throstle and doubling frames for spinning and doubling fibrous materials. Dated Oct. 11, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2543. W. E. Newton. *Improvements in the condensers and condensing apparatus of steam engines.* (A communication.) Dated Oct. 11, 1861.

The patentee claims the combination of a surface or external condenser placed between the side pipes, and the ordinary condenser of a steam engine, with a cooler for cooling the water from the hot well. This cooler is placed between the hot well and the ordinary condenser, so that the steam, after being partially condensed by the external condenser, will then be further condensed by means of the injection of the cooled water from the hot well into the ordinary condenser. *Patent completed.*

2544. N. Straam. *Improvements in watches.* Dated Oct. 11, 1861.

Watches called "remontoir" have already been made, that is to say, watches that can be wound by means of an axis, on the end of which is a head adapted to the pendant of the watch. Watches have also been made, called "reversible," that is to say, the works of the watch are contained in an open faced case, which is itself enclosed in a second open faced case; so that the interior case being reversible, it forms with the exterior case a hunting watch, if its back is adapted to the open ring of the exterior case, or an open faced watch if its dial is placed beneath the ring of the outer case. This invention consists in the combination of the above two systems. For this purpose the interior case which contains the watch movement is fixed on a pilot adapted to a joint fixed on the middle part or "collier" of the exterior case; so that by reversing the interior case on this pivot, a hunting watch or an open faced watch is obtained. The winder consists of a head fixed on the end of an axis connected with the works of the watch; this head is exactly opposite to the pivot uniting the two cases, so that the head always comes to the same point of the middle piece of the exterior case; at this point an opening is made to admit the head, and this opening is made in such manner that, when the exterior case is closed, the watch has the appearance of an ordinary open faced watch, or an ordinary hunting watch. *Patent completed.*

2545. J. Clark. *Improvements in electric telegraph apparatus, and in means for submerging and raising electric telegraph sea cables.* Dated Oct. 12, 1861.

We cannot here give space to the voluminous details of this invention. *Patent abandoned.*

2546. E. Corke. *An Improved instrument to be attached to the bayonet or barrel of a rifle or other fire arm for estimating distances.* Dated Oct. 12, 1861.

This instrument is intended to be attached with facility on the bayonet or barrel of a rifle or other arm, the purpose being to place it as far from the eye as possible, so that the object to be aimed at shall entirely fill the aperture of the said instrument or gauge, to the exclusion of all surrounding objects. The instrument consists of a gauge with a vertical slot or aperture furnished with a vertical slide in the usual manner. Each side of the said aperture is marked with a scale to suit objects of different heights, ranging at distances of fifty yards upwards. *Patent abandoned.*

2547. R. Edge. *Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.* Dated Oct. 12, 1861.

This consists in a mode of drawing the spindles of machinery employed for preparing, spinning, and doubling, without the aid of belts or bands. *Patent abandoned.*

2548. S. R. Carrington. *Improvements in hats or caps.* Dated Oct. 12, 1861.

This consists in indenting or corrugating the material of which the body of the hat or cap is formed at the lower part of the crown of the hat or cap through the band, the leather or pad being tight, so as to fit the head of the wearer, whereby at each indent or corrugation the patentee obtains an aperture for the admission of the air into the interior of the hat or cap whilst being worn. *Patent completed.*

2549. J. C. Ramsden. *Improvements in healds or heddles for weaving, and in the machinery or apparatus for making the same.* Dated Oct. 12, 1861.

These improvements consist in having three continuous threads, one of which to form the loop is lapped by suitable mechanism round the other two, then drawn up to the rigband or selvage of the heald, and there fastened; hence the patentee obtains a perfect loop without knots. *Patent completed.*

2550. V. Pirson and A. Devaysee. *The application of a new material in the manufacture of paper, card-board, and yarns.* Dated Oct. 12, 1861.

This consists in the use of the lucern root or Spanish trefoil, for the purposes aforesaid. *Patent abandoned.*

2551. E. T. Hughes. *An improved compound to prevent the incrustation and sediments of calcareous matters in boilers.* (A communication.) Dated Oct. 12, 1861.

This consists in combining the following articles in about the proportions stated, viz., alum, 25 kilos, salts of soda 25 kilos, red ochre, 2 kilos, sulphuric acid, 3 kilos, 500 grains, brown fecula of potatoes, 15 kilos. *Patent abandoned.*

2552. H. Nelson. *Improvements in machinery or apparatus for punching washers of throstles and other similar purposes* Dated Oct. 12, 1861.

This invention consists of two rollers or cylinders revolving in suitable bearings between which the cloth or material to be punched passes. On one of the said rollers or cylinders are one or more projecting cutters, so that, as the material to be perforated comes in contact with each cutter, the requisite hole is punched; and to cause the material to pass through or between the rollers regularly without slipping, one or both of them are grooved or fluted, and at the front of the apparatus any suitable guides may be fixed to keep the material in a straight direction. The required distance of the perforations is regulated by the diameter of the roller, and, consequently, the distance of the punches assured. *Patent completed.*

2553. R. C. Furley. *Rendering pills tasteless.* Dated Oct. 12, 1861.

This invention consists in covering pills with albumen. *Patent abandoned.*

2554. M. Cartwright. *Improvements in stench traps.* Dated Oct. 12, 1861.

This consists in covering the closing plate or trap either wholly or partially on its closing side with vulcanized india rubber, alone or in combination with other suitable materials, a similar covering being applied to the surface upon which the flap closes, so that a perfectly tight joint is obtained. *Patent abandoned.*

2555. A. V. Newton. *Improved machinery for dressing or cleaning wheat and other grain.* (A communication.) Dated Oct. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2556. G. Twigg. *Improvements in clasps or fastenings for stay busks.* Dated Oct. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2557. C. R. M. V. De la Jousselandiere. *A machine for the weaving of cords and ropes.* Dated Oct. 11, 1861.

This consists of a hollow sphere with sloping apertures in which conical pieces will turn, and by channels (say four) on their surface carry with them contiguous spindles and bobbins; thus each of the spindles, moving on a cone and within a sphere, will always tend to one point, namely, the centre of the sphere, and consequently, the thread or strand will always be stretched, and the twisting or weaving point move in proximity to a mathematical point. Each of the cones is set in motion by a gearing placed on the same axle, and the motor is placed indifferently on one or other of the axles, working all the gearings which command each other, forming a hexagon around the sphere. By means of return pieces or cramps the spindles pass successively from one cone to the other, and thus, alternately rising and falling and making the entire circuit, effect the twisting of the threads or strands. To prevent the spindles turning on their own axis during their translation, and thereby either twist or wind off the thread or strand, the inventor applies to their hind part a pin or stud, which acts as a buffer against a similar piece behind each channel in the cones. *Patent abandoned.*

2558. W. Macnab. *Improvements in marine steam engines and boilers.* Dated Oct. 14, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2559. H. J. Distin. *Improvements in metal musical wind instruments.* Dated Oct. 14, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2560. J. Browning. *Improvements in barometers* Dated Oct. 14, 1861.

This invention relates to those barometers in which hands or needles are used to indicate the state of the atmosphere, and consists in adding two loose hands or indicators which will yield without offering appreciable resistance to the barometer needle, and be pushed thereby and remain stationary, until reset, at the points where so pushed, and thus register the extremes of the barometer needle in both directions, since the setting of the instrument. *Patent abandoned.*

2561. B. Taylor and C. Erkins. *Improvements in porte-robes or dress suspenders, and also in apparatus for the suspension of curtains, draperies and other articles.* Dated Oct. 14, 1861.

This invention consists, first, in improvements in porte-robes or dress-suspenders by making such dress-suspenders a part of or combined with a waist-belt, of the ordinary description worn by ladies, employing hooks or dress clips suspended by a cover or chain running through eyelet-holes in the waist-belt, so that the cords upon which the hooks or dress-clips are hung is easily adjustable to a greater or less length, to suit the convenience of the wearer. The invention consists also in improvements adapted for the suspension of curtains and draperies used with French bedsteads. A tubular ring of metal is substituted for the belt already described; this ring is to be screwed, in the manner usual with such draperies, into the ceiling or other joists, the cord or chain passing in the interior of the tubular ring, and the loops for the hooks through perforations in the ring; from these hooks the curtains are to hang, or the chain and hook may be employed if desired. *Patent completed.*

2562. F. B. Houghton. *Improvements in apparatus employed in reducing straw and other vegetable substances in the manufacture of pulp for making paper.* Dated Oct. 14, 1861.

Here the patentee employs a boiler of a cylindrical form with hemispherical ends, and within this boiler a shaft or axis works, passing through a stuffing box at one or both ends. On this shaft are fixed several bent or curved blades, the edges of which are bent up so as to form scoops; these blades are fixed at intervals all round the shaft, and they are of a length to come within a few inches of the inner surface of the boiler. To this shaft rotatory motion is communicated, by which the materials under operation are continuously moved and raised out of the alkaline solution in the lower part of the boiler, which is about one third filled with that fluid. The boiler is heated from the interior by water circulated in closed pipes or tubes, on Perkins' principle. When the boiler and the materials therein are to be cooled, water is pumped into the boiler. *Patent completed.*

2563. M. Walker. *Improvements in breech-loading rifles.* Dated Oct. 14, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

2564. J. Flinn. *An improvement in watches.* Dated Oct. 15, 1861.

The patentee claims the addition to watches having a spring and barrel of the kind called a "gong barrel," or watches without a fusee, of a wind-up consisting of a toothed wheel, taking into or engaging with another toothed wheel on the axis of the said gong barrel, to the axis of which wind-up the key of the watch is applied in winding; the direction of the winding is reversed. *Patent completed.*

2565. C. Wynants. *An improved chase for printing presses.* Dated Oct. 15, 1861.

This consists in so constructing chases used in printing that the pages of type placed thereon may be tightened and firmly secured in position by eccentrics, or volutes, or scrolls, governed by a key or other means, to cause them to press against the setting rules, and by them upon the pages of type to secure them tightly in the chase; and on turning the eccentrics, volutes, or scrolls in an opposite direction, the type is immediately released from pressure, and may be removed and changed with ease. By this means, binding the pages of type is avoided, and the type is prevented from slipping or falling into pie. *Patent completed.*

2566. W. Bland. *Improvements in pickers used in looms for weaving.* Dated Oct. 15, 1861.

This consists in strengthening those parts of pickers which have principally to sustain the shock in striking against the shuttle. For this purpose the inventor laps the outer fold of the buffalo hide, leather, or other material of which the picker is made, over the side of the picker to the back end of the same, and secures it there with one or more staples and rivets, thus changing the T-shape of the picker into 1, or other suitable shape, and turning in the outer fold of the material edgeway to the work, or parallel to the spindle on which the picker slides. The picking band or strap being fastened as usual he provides the necessary space for it to pass the outer fold where it laps over the side. *Patent abandoned.*

2567. W. Ross. *Improvements in constructing taps or valves.* Dated Oct. 15, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2568. J. Gilbert. *Improvements in endless railways.* Dated Oct. 15, 1861.

This consists in so constructing an endless railway that each short piece of rail shall be moved in regular succession, so that at least one length is at rest on the road for the wheel to roll upon, and when the wheel has passed over it is then taken up and carried over the top of the wheel, and again placed in position under the running wheel. The rails, chairs, and sleepers are so connected together that no depression can take place at the joints of the rails when the wheel is passing over them, but form one continuous and unyielding rail. *Patent completed.*

2569. W. E. Newton. *Improvements in the condensers and condensing apparatus of steam-engines.* (A communication.) Dated Oct. 15, 1861.

This invention comprises much detail which we cannot produce hear. *Patent completed.*

2570. R. A. Brooman. *Improvements in propelling ships and vessels.* (A communication.) Dated Oct. 15, 1861.

This invention relates to feathering propellers, and continuous propulsive effect is obtained by means of two sets of propellers on each side of the vessel. The floats are always submerged and nearly vertical; when propelling they act successively upon fresh bodies of water; after performing their stroke they are returned in a horizontal position or feathered, and when about to repeat their stroke they are made to assume a vertical position. When two floats are used instead of one they are set one below the other. To go astern, the inventor adopts arrangements whereby the propellers may be made to drive the vessel backward without altering the stroke of the piston in the steam cylinder. The propellers may be applied at the stern of vessels, particularly those used on canals. *Patent abandoned.*

2571. J. Dixon and R. Clayton. *Improvements in the construction of railway wheels.* Dated Oct. 16, 1861.

Here the patentees make a dovetailed recess at one side of the tyre on a V-shaped projection on one side of the felloe. At the other side of the tyre is a groove, and another groove is made in the felloe; an annular clip or cramp slightly fits into these two grooves, and when in its place the tyre and felloe are hammered up so as to retain the clip or cramp. Or an annular clip or cramp, segmental clips or cramps of any convenient length may be used, and in this case the grooves in the tyre and felloe may be square in those parts into which the clips or cramps enter, and dovetailed in the immediate parts which are hammered up to retain them in their places. Or the segmental clips or cramps may fit into square grooves in tyre and felloe, and be secured therein by hammering up on to the dovetailed parts, or the clip or cramp may fit in the groove in the tyre and under the rim of the felloe. *Patent completed.*

2572. R. A. Brooman. *An improvement in plates.* (A communication.) Dated Oct. 16, 1861.

This invention consists in manufacturing plates with divisions or partitions in them for the purpose of keeping the meat, vegetables, sauces, &c., separate from each other. *Patent abandoned.*

2573. F. B. Baker. *Improvements in dressing or stiffening lace and other fabrics.* Dated Oct. 16, 1861.

According to this invention the patentee causes the fabric to be dressed or stiffened to pass in contact only with a roller, which is kept coated with a film of dressing material. This dressing roller revolves constantly, and receives its film of dressing from another roller against which it rests by its own weight, and which latter roller dips into a trough containing the stiffening material. It is the back of the fabric which comes in contact with the dressing roller, and it bears but lightly upon it, so that the dressing is not pressed through to the face of the fabric, and the quantity of dressing on the dressing roller is so adjusted as not to be sufficient to soak through it without pressure. After the fabric leaves the dressing roller it passes over another roller covered with soft material, which removes from the interstices of the fabric any dressing which may have entered and filled them. But the filling of the interstices of the fabric is for the most part avoided by the proper regulation of the quantity of dressing on the dressing roller. *Patent completed.*

2574. T. Forster. *Improvements in re-working waste vulcanized india-rubber.* Dated Oct. 16, 1861.

Here the vulcanized india-rubber is suitably reduced by crushing rollers, or otherwise, and is then mixed with gutta-percha and sulphur. Pigments may be added to the mixture of vulcanized india-rubber, gutta-percha, and sulphur, if desired. *Patent completed.*

2575. J. J. Adams. *A new and useful improvement in the manufacture of flexible back brushes, for cleaning and dusting horses and other animals.* Dated Oct. 16, 1861.

This invention consists in an improved mode of manufacturing a flexible brush, having its body made of leather, or any other suitable flexible material, all the rows of bristles except the outer one being first drawn into the body portion of the brush, next the top or cover-plate being cemented to the body part, and, finally, the last or outside row of bristles being drawn into the holes formed in the body portion by means of a wire passing down through the body and cap-plate of the brush. This mode of applying and securing the last row of bristles enables the patentee to entirely dispense with the line of sewing required by the old method to be made entirely around and through the brush, in order to confine the body and cover or hand-plate together. *Patent completed.*

2576. A. V. Newton. *Improvements in the construction of grain and grass harvesters.* (A communication.) Dated Oct 16, 1861.

This invention is not described in detail apart from the drawings. *Patent completed.*

2577. W. Biddell. *Improvements in the manufacture of shot.* Dated Oct. 16, 1861.

The inventor takes iron in a molten state, and alloys it with nickle, arsenic, or lead, preferring the oxides of these metals. These are to be intimately mixed with the molten iron. He can employ each alloy separately with the iron, or all combined. The hot metal is then granulated by being run over a polished surface through combs which regulate the size, the polished surface being agitated during the operation. The shot being thus produced, he proceeds to coat it to prevent oxidation. This may be done by galvanizing, turning, coating with mercury, or any other equivalent process. He can also, by this process, make shot of iron alone unalloyed. *Patent abandoned.*

2578. W. Clark. *Improvements in the means or apparatus for closing and securing mail bags and other packages.* (A communication.) Dated Oct. 16, 1861.

This consists in the use of a piece of copper with the surface hollowed out to receive a knot at the end of a piece of cord, the said hollow with the knot therein being filled with sealing wax, the whole being so arranged as to prevent the package thus secured from being opened without detection. *Patent completed.*

2579. J. Lister and D. Myers. *Improvements in lifting or hoisting apparatus, whereby to ensure the safety of the cage or article lifted when a rope or chain breaks or is overwound, and in hoists generally, as applied to mills, warehouses, and other buildings.* Dated Oct. 16, 1861.

These improvements in apparatus for arresting the fall of the cage or basket in a mine, relate, first, to a combination of parts connecting the rope or chain with the article to be lifted. 2. To means for preventing the overwinding of the rope, whereby accidents often occur from the cage being pulled over the top pulley. The details of the invention are voluminous. *Patent completed.*

2580. W. Smith. *Improvements in the apparatus for and method of increasing the illuminating power of gas.* (A communication.) Dated Oct. 17, 1861.

This invention consists in the use of a box containing capillary arrangements or apparatus, as described, for producing an atmosphere of benzone vapour for the purpose of charging the gas passed therethrough, as set forth. Also, in the use or employment of the capillary arrangement or apparatus described, whether benzone or any other liquid carbon be employed, for the same or similar purposes. *Patent completed.*

2581. R. Hayes. *Improvements in gun and ammunition carriages.* Dated Oct. 17, 1861.

This consists in a method of constructing gun carriages with three wheels, one at each side and one in front of the carriages, so that one or two men may be able to push them about in connection with rapid infantry movements. *Patent abandoned.*

2582. L. A. J. Daclanque. *Improvements in the machine to decorticate corn and seeds.* Dated Oct. 17, 1861.

Provisional protection has not been allowed for this invention.

2583. W. T. Weston. *Improvements in screw wrenches.* Dated Oct. 17, 1861.

This consists in forming on either side of the handle of a screw wrench, containing one fixed jaw or chop thereof, a toothed rack, the situation of which is at that part of the handle of the wrench along which the movable jaw or chop is to slide, and in furnishing such movable jaw with an eccentric thread or helical worm formed on a disc or button having a milled edge, the disc being perforated with holes similar to a windlass or capstan, and placed with its pivot perpendicularly with regard to the rack into which it works, so that by turning such screw or thread by means of its milled edge, or by the application of a lever to the holes, the movable jaw is caused to move along the rack as may be desired with respect to the fixed jaw of the wrench. *Patent completed.*

2584. W. Welch. *Improvements in marine screw propellers.* Dated Oct. 17, 1861.

This relates to the position and form of the spiral curvature and cylindrical surface of the blade or blades, which, instead of varying in their width of surface, shall be of uniform dimensions throughout their entire length; and the outer or entering ends of the blades, instead of maintaining the pitch or passing the axis at an angle, are made the neutral or vanishing points of the screw, and, rotating in a disc, form in a line at a right angle with the axis or parallel with the midship section of the vessel, while the conjunction of the blades with the propeller shaft is placed at a right angle with the opposing end, or parallel with the water line, each blade thus forming a curved cylindrical surface, the ends crossing at an angle of 45°, or both blades combined producing a true screw, the ends crossing at an angle of 90°. *Patent completed.*

2585. R. Smith and J. B. Rowcliffe. *Improvements in apparatus for winding yarn or threads on pin-bobbins or spools used in smallware and ribbon looms.* Dated Oct. 17, 1861.

This invention consists in so constructing pin winding machines that any required number of threads may be wound together, and with an even tension on each pin-bobbin, also, when either or any of the pin-bobbins is or are full, that the same will be disconnected from the driving power, and cease to take up any more thread or threads, without affecting the remaining pin-bobbins that are not sufficiently filled. A stopping apparatus is connected with each pin-bobbin to disconnect the power in case the threads should break or run out. The length of the traverse given to the guides which direct the threads on to the pin-bobbins is gradually shortened as the pin-bobbin fills, that the ends of the same may be tapered, which enables the patentees to dispense with flanges to the pin-bobbin. *Patent completed.*

2586. C. De Groote. *An improved instrument for corking bottles and other vessels.* Dated Oct. 17, 1861.

This consists, under one modification, of a stand to which are affixed the following parts:—1st. A hollow vessel in which the bottle to be corked is placed, the said vessel being formed raised at the centre thereof for the bottle to stand upon. 2nd. A taper glass or porcelain tube, connected and adjusted to the vertical part of the stand, so as to admit the vessel to be corked to be placed underneath the same. 3rd. A plunger rod working through guides fixed to the vertical part of the stand, to maintain the plunger rod in a line with the centre of the glass or porcelain tube, the said plunger rod being for the purpose of forcing a cork into the vessel, to be corked by means of a lever handle connected to the said plunger rod. In connection with the above it is proposed to employ a small semi-tbubular piece of metal, which is inserted in the neck of the vessel, so that as the cork is being forced into the vessel the air therein, as it is compressed, will be allowed to escape up the semi-tubular channel thus formed; the semi-tube is then withdrawn, the cork filling up the space. *Patent completed.*

2587. J. Tattersall. *Improvements in the construction of carding engines used in the preparation of cotton and other fibrous substances for spinning.* Dated Oct. 17, 1861.

This consists, 1, of an extra roller placed above the ordinary "licker in" and in contact with it, and with the main cylinder. This extra roller is covered with wire card teeth, and is caused to revolve at a suitable velocity in such a manner that its surface, when it is in contact with the main cylinder, travels in the opposite direction to that of the main carding cylinder. The 2nd part of the invention consists of a screen, formed of any suitable material, which encloses the upper part of the "licker in," the extra card roller above named, that part of the main cylinder between the extra roller and the first roller clearer, and also the lower part of the first roller clearer. The screen is so constructed as to regulate the quantity of air to be admitted to the rollers and cylinders, and thus prevent or lessen the draughts incident to ordinary carding engines. *Patent abandoned.*

2588. T. Wild and T. Hodson. *Certain improvements in the method of heating the feed water for steam boilers, and in employing steam produced by such means.* Dated Oct. 17, 1861.

This consists in the use of a novel tube or supplementary boiler placed in the return flue, or in the space between the two ordinary boilers, and in passing the feed water through the said tube or boiler, the products of combustion from the furnaces of the ordinary boilers being caused to circulate around or pass over the outer surface of the additional tube or boiler before passing to the chimney by which means the feed water is heated, and a portion of the impurities deposited therefrom before entering the ordinary boilers. The additional tube or boiler is connected by means of pipes with a steam reservoir or holder, fitted with a safety valve or valves, and communicating with the steam spaces of the ordinary boilers, or with the main steam pipes in connection therewith, through a valve or ony other suitable apparatus, by which arrangement the steam generated in the tube or boiler may be employed for any purpose for which it may be required. *Patent abandoned.*

2589. S. E. Merritt. *Improvements in apparatus for obtaining motive power.* Dated Oct. 17, 1861.

This consists in obtaining motive power by means of a cylinder and piston, the piston being stationary, and the cylinder receiving the reciprocating motion due to the steam or other pressure within the cylinder. *Patent completed.*

2590. R. Aytoun. *Improvements in apparatus to be applied to chimneys or flues for improving the draught therein, and for preventing down draughts or the descent of smoke into apartments.* Dated Oct. 17, 1861.

This apparatus consists, under one modification, of a horizontal valve seat or frame, fixed air tight on the interior of the chimney or flue, either immediately above the fire grate, or in any other part of the chimney, or in or upon the chimney top. The actual working face of the seat is formed at an angle, and the valve itself is fitted to vibrate on knife edge or other centres or journals carried by the frame, a suitable stop being fitted upon the frame to prevent the valve from opening back too far. Whenever there is a tendency to a "blow down," to produce what is known as a "down draught," the external pressure from above at once closes the valve, and the discharge of smoke downwards is immediately checked. *Patent abandoned.*

2591. W. Crooks. *Improvements in lamps.* Dated Oct. 18, 1861.

The patentee claims the combination of the reflecting reservoir with the wick holder, level with or raised slightly above the top of the reservoir, with the reflecting reservoir wholly or in part surrounding the wick holder, with the reflector placed above, as described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Jan. 11, 1862.

107. S. W. Marsh, city of Washington, U.S. Improvements in breech loading fire-arms.

Dated March 21, 1862.

782. D. E. Siebe, Mason-street, Lambeth, engineer and machinist. Improvements in machinery or apparatus for refrigerating or producing cold, part of which improvements are applicable also to other purposes.

784. W. J. Curtis, 13 Tuffnell Park-road, Holloway, C.E. An apparatus to ascertain and point out the fares and earnings or receipts of public vehicles and their conductors.

Dated March 31, 1862.

899. L. B. Schmolle, John-street, Golden-square, importer of French goods. Improvements in the construction of crinolines or steel skirts.

Dated April 2, 1862.

923. G. Holcroft, Manchester. Improvements in the construction of blast furnaces.

935. W. Leopard, Hurstpierpoint, Sussex, corn merchant. Improvements in railway brake apparatus.

Dated April 3, 1862.

937. G. Rebour, 15 Passage des Petites Ecuries, Paris, advocate. A permanent autographic log serving to measure, and if needed to retrace graphically the swiftness and sailing of a ship, the rapidity of streams, and the propelling of rising and ebbing tides.

941. J. Newton, 5, Montpellier-road, Rye-lane, Peckham, contractor. Improvements in the construction of breakwaters, piers, and sea walls.

943. R. M. Toogood and J. Laybourne, both of Newport, Monmouth, engineers. An improvement in railway crossings.

945. M. Amos, Westbury-on-Trym, Gloucester. Improvements in harrows.

949. W. A. Richards, Chester-cottage, Cornwall-place, Holloway, commercial clerk. Improvements in the manufacture of bags, and in fastening and locks for bags, parts of the invention being also applicable to purses, cigar cases, reticules, and other similar articles.

Dated April 4, 1862.

951. J. F. Woodall, 28 Orchard-street, Portman-square. Improvements in ventilating carriages for common roads.

953. F. Spencer, Pendleton, Lancaster, manufacturer. Certain improvements in looms for weaving.

954. W. Ryder, Bolton-le-Moors, Lancaster, roller and spindle maker. Improvements in the construction of machines for forging metals.

955. F. C. Bakewell, 6 Haverstock-terrace, Hampstead. Improvements in letter printing machines. (A communication.)

957. L. Lindley and F. Taylor, sewing machine manufacturers, Melbourne-street, Mansfield-road, Nottingham. Improvements in sewing and embroidering machines.

959. G. Moulton, Manchester, engineer. Improvements in pentagraph machines used for engraving rollers or cylinders employed in calicoes and other surfaces.

961. A. J. Hale, William-street, Margaret-street, Clerkenwell, die sinker. Improvements in instruments for drawing ovals.

963. S. Fielding, S. Fielding the younger, R. Fielding, and T. Fielding, Smallbridge, near Rochdale. Improvements in valves and in apparatus for lubricating the same and other parts of steam engines.

965. J. Secales, of Lloyd's, London, surveyor. Improvements in steering ships.

966. W. E. Newton, 66 Chancery-lane. Improvements in the manufacture of iron and steel. (A communication.)

967. W. E. Newton, 66 Chancery-lane. Improvements in pumps for ships' use and other purposes. (A communication.)

969. J. Nock and W. K. Price, Birmingham, gas stove manufacturers. An improvement or improvements in gas cooking ranges.

Dated April 5, 1862.

973. H. J. Simlick, Baker's Arms-gardens, Wellington-row, Bethnal-green, vesuvian manufacturer. Improvements in the manufacture of vesuvians or cigar lights.

975. A. Clark, Gate-street, Lincoln's-inn-Fields, revolving shutter manufacturer. Improvements in the manufacture of revolving window shutters and blinds, in window sash bars and plates, also in apparatus used in such manufactures.

976. L. Facconnet, 52 Rue du Transit Vaugirard, Paris, tile manufacturer. A new kind of tiles.

977. R. A. Kobitzsch, Bucharest, Wallachia. Improvements in diving apparatus, and apparatus to be used for working in deep water.

Dated April 7, 1862.

981. T. Smith, Salford, Lancaster, machinist. Improvements in machinery for cutting and shaping screw bolts and other articles.

983. A. Harris, Birmingham, Warwick, gun barrel manufacturer. An improvement or improvements in the manufacture of gun barrels.

986. W. N. Nicholson, Newark, Nottingham, agricultural implement maker. Improvements in ranges and stoves.

987. T. Jackson, Orchard-street, Portman-square, pianoforte manufacturer. Improvements in pianofortes.

Dated April 8, 1862.

991. J. Brown, Aldgate, chemist. Improvements in protecting the bottoms and sides of ships, and other entirely or partially submerged surfaces.

995. The Hon. W. E. Fitz Maurice, 12 Hyde-park-gate. An improved construction of plating for ships, batteries, and other structures used for war or other purposes.

997. F. W. Brearey, 53 Cornhill. Improvements in medicated cups or vessels for drinking purposes.

1003. J. Lawson, partner in the firm of S. Lawson and Sons, Hope-foundry, Leeds. Improvements in balling cotton and thread. (A communication.)

1005. T. Cobley, metallurgist, and J. Wright, both of 42 Bridge-street, Blackfriars. Improvements in the method of, and the apparatus for, treating auriferous and argentiferous minerals and ores for the purpose of extracting and separating the gold and silver from the other metals, minerals and substances combined therewith, also in the method of treating the various residues resulting therefrom, and in the utilization, application, and use of the said residues when so treated.

Dated April 9, 1862.

1007. J. E. H. Andrew, Audenshaw, Lancaster, machinist. Improvements in looms for weaving.

1009. G. Hollinshed, Salford, near Manchester, Lancaster, designer. Improvements in sandwich cases and similar articles.

1011. W. Taylor, Oldham, Lancaster, cotton spinner. Certain improvements in machinery or apparatus for preparing and spinning cotton or other fibrous materials.

1013. C. Mather, Willow-bank, Brompton, near Manchester, gentleman. Improvements in spittoons.

1017. W. E. Newton, Chancery-lane. An improved apparatus for raising and forcing water and other liquids. (A communication.)

1019. R. Theyson, Hanover. Improvements in cork cutting machinery.

Dated April 10, 1862.

1020. F. Funnell, 54 East-street, Brighton, watch and clock manufacturer. An improved self-acting indicator signal for railways.

1025. A. Black, Banbridge, Down, Ireland, law-clerk. Improvements in swing bridges adapted for crossing lines of railways and other ways.

1027. C. P. Coles, Southsea, Hants, Capt. R.N. Improvements in masts for ships.

1029. L. Christoph, Paris, W. Hawksworth, Linlithgow, steel manufacturer, and G. P. Harding, Paris, merchant. Improvements in drawing metals, and in the machinery or apparatus employed therein.

1031. J. Platt, Oldham, Lancaster, mechanical engineer, W. Richardson, mechanical engineer, and W. Holland, Salford, cotton spinner. Improvements in carding engines.

1033. G. Burge, Albert-road, Regent's-park, contractor. An improved means of protecting forts, ships, and other structures and places against projectiles and other striking bodies.

1035. O. Reynolds, Debach, near Woodbridge, Suffolk, clerk. Improvements in building ships and other vessels.

1037. W. Fox, Amiens, France. Improvements in the manufacture of brooms and brushes.

Dated April 11, 1862.

1039. H. Holland, Birmingham, manufacturer. Improvements in manufacturing the stretcher joints of umbrellas and parasols

1040. J. T. Grice, Birmingham, tube maker. Improvements in the manufacture of twisted metallic tubes.

1042. J. Garnett, Windermere, Westmoreland, printer and stationer. Improvements in apparatus for washing photographic pictures.

1044. J. P. Mathias, 22 Rue de Chalons, Paris, hat manufacturer. An apparatus for pressing and ironing straw hats of any shape or form.

1045. P. Rigollot, 15 Passage des Petites Ecuries, Paris. Improvements in machinery or apparatus for manufacturing riveting pegs for boots and shoes and other pins or pegs.

1046. J. M. Landmann, incumbent of the parish of Ste Croix, Algiers, Algeria. Improvements in hydraulic engines.

1047. T. Knowles, J. Houghton, W. Knowles, and W. Houghton, Gomersal, York, machine makers. Improvements in looms for weaving.

1048. E. Butterworth, Calder-cottage, near Rochdale, Lancaster. Improvements in machinery for applying adhesive substances to preserve the form of cops of yarn.

1049. W. Clark, Chancery-lane, Middlesex, engineer and patent agent. Improvements in the manufacture of leathern accoutrements. (A communication.)

1050. W. Bush, Tower-hill. Improvements in the construction of ships and shields.

1053. I. Whitesmith, Glasgow, machine maker. Improvements in power looms, and in pirn winding apparatus.

Dated April 12, 1862.

1055. N. Nussey, Holbeck, Leeds, mechanic. Improvements in machinery or apparatus for preparing and combing wool, flax, hair, cotton, silk, and other fibrous materials.

1056. E. Bollée, Le Mans, department of La Sarthe, founder. A new hydraulic ram.

1057. A. Sweet, Hampstead-road, ironmonger. Certain improvements in locks and latches.

1058. E. Drewett, Blackheath, Kent, photographer. Improvements in bottles and other vessels whereby to separate and retain sediment from their contents.

1059. A. S. Campbell, Hampstead, gentleman. Improvements in surface condensers.

1060. A. S. Campbell, gentleman. Improvements in the refrigeration of liquids.

Dated April 14, 1862.

1061. J. Park, Bury, Lancaster. Certain improvements in or applicable to steam engines.

1062. E. Peyton, Birmingham, manufacturer, and W. F. Bath, manager. Improvements in angle iron, applicable to metallic bedsteads, roofs, bridges, and other similar purposes.

1063. J. F. Spencer, Newcastle-on-Tyne. Improvements in steam engines.

1064. H. C. Lee, 11 Lawrence Poultney-lane. Improvements in knitting machines.

1066. J. Beard, Leonard Stanley, Gloucester, mechanical engineer. An improvement or improvements in sofa beds or sofa bedsteads.

1067. J. M. French, Birmingham, Warwick, pianoforte manufacturer. Improvements in upright pianofortes.

1068. J. Darlington, 26 Gresham-street, mining engineer. Improvements in the arrangements of marine telegraph wires and cables.

1069. J. K. Hampshire, Whittington, Derby. A safety cage with disconnecting catch to prevent accidents in the working of coal or other mines arising from the over winding or breaking of the ropes or other parts used for hoisting purposes.

1071. C. Harratt, Hornsey-lane, Highgate. Improvements in the manufacture of masts, yards, and booms.

1073. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in reaping and mowing machines. (A communication.)

1075. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in pumps. (A communication.)

1076. R. A. Brooman, 166 Fleet-street, patent agent. An improved hobby horse. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1124. G. T. Bousfield, Loughborough-park, Brixton. Improvements in sewing machines. (A communication.) Dated April 17, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

3163. J. Dale. Glue or size.

3165. J. Platt and W. Richardson. "Gins" for cleaning cotton from seeds.

3166. R. Scott. Rifling or grooving the barrels of fire-arms and ordnance.

3173. J. Piddington. Condensing apparatus for steam-engines. (A communication).

3175. C. E. Symonds. Treatment and application to various useful purposes of light spirituous liquids.

3179. C. Pontifex. Refrigerators

3183. E. Stott. Collecting and removing of waste and dirt which occurs in the process of spinning cotton &c.

3187. J. Standfield and J. Standfield. Apparatus for giving motion to ships and machinery, and for raising water.

3193. G. Walkland. Machine for winding lace.

3194. W. Tipple. Paddle-wheels.

3195. V. D'Almeida. Colouring matter applicable for dyeing skins, silk, wool, &c. (A communication.)

3200. R. Wailes. Apparatus for cleaning windows and glasses.

3207. F. Grimaldi. Rotatory steam boilers.

3211. F. Selby. Boilers.

3216. C. Smith. Stays.

3218. C. Smith. Stays.

3223. E. B. Sampson. Drying wool.

3226. J. Cochrane. Sinking cylinders and open coffers for forming foundations.

3230. T. Standing. Cinder sifters and ash receptacles.

3234. J. Shepherd. Cleansing steam boilers.

2240. W. Turner and J. W. Gibson. Rolling bridges.

3242. T. Bright. Machinery for cutting hay, &c.

3245. J. McIntyre. Bomb shells.

3255. J. Gordon and B. Henderson. Ropes.

13. W. B. Patrick. Manufacture of sugar.

18. W. E. Gedge. Roasting coffee. (A communication.)

20. W. A. Fell. Bobbins.

53. C. Pilkington and T. Pilkington. Skates.

71. J. Carter. Draining plough.

73. M. Wigzell. Double acting ventilator.

90. F. C. Worlich. Artificial fuel.

106. W. Gorse. Brads.

107. S. W. Marsh. Breech-loading rifles.

174. W. H. Ropes. Cleaning coffee, rice, &c. (A communication.)

188. T. Morris, R. Weare, and E. H. C. Monckton. Submarine and other telegraphic communication.

293. J. L. Norton. Beating, stretching, and drying fabrics. (Partly a communication.)

309. A. V. Newton. Fire-arms. (A communication.)

368. T. Coltman. Sewing machines.

388. W. D. Allen. Stamp heads and beds employed in crushing ores, &c.

389. G. C. Burrows. Lounges, seats, and rocking horses.

468. S. Smith. Electro-magnetic engines.

494. T. Partridge. Printing railway and other tickets.

503. J. Piddington. Condensing apparatus.

635. F. B. Newton and H. Codd. Measuring the flow of liquids.

647. J. B. G. M. F. Piret. Lubricating apparatus.

841. W. L. Winans. Manœuvring ordnance in land fortifications.

929. G. Collier and J. Collier. Looms.

994. J. Whitehouse. Metallic door and other knobs.

1124. G. T. Bousfield. Sewing machines. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated April 25, 1862.

2691. W. Taylor.
2693. G. Hutton.
2702. J. Watt.
2708. W. H. Furlonge.
2711. J. Eaglesfield.
2712. J. S. Jackson.
2714. J. Hayward.
2716. J. H. Johnson.
2735. G. Holcroft.
2744. R. Mushet.
2761. G. Evans.
2801. H. Montucci.
2824. W. Clark.
2837. G. Davies.
2850. W. Clark.
2949. E. A. Rouvière.
2973. G. Bottomley.
2996. S. Amphlet.
3001. S. A. Carpenter.
3015. E. Tyer.

Dated April 29, 1862.

2726. E. De Bassano.
2742. J. Higgins.
2752. J. S. Brooks.
2753. A. F. Yarrow.
2754. J. C. Wilson.
2757. J. French.
2759. S. Osborne.
2763. T. Spenser and T. Robinson.
2770. W. T. Weston.
2772. R. Wilson.
2776. C. F. Hayes.
2778. R. A. Brooman.
2788. W. Ramsell.
2792. J. Walmsley.
2830. J. J. Shedlock.
2862. A. E. Carter and J. Hack
2869. M. Wigzell.
2870. R. Heath.
2884. M. Gibson.
2972. C. Stevens.
3078. C. F. Varley.
3270. W. E. Newton.
99. J. G. Marshall.
111. J. G. Marshall.
206. S. A. Carpenter.
225. G. J. N. De Ridder.
275. F. W. Daehne.
302. E. F. Smith and J. Swinerton.
357. J. H. Johnson.
395. S. B. Whitfield.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1025. J. Marshall, jun.
1040. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.
1051. J. H. Johnson.
1065. C. Randolph and J. Elder.
1062. Sir T. T. Grant.
1074. A. Boyle.
1082. W. Winstanley and J. Kelly.
1120. J. G. Willans.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

921. L. A. Avisse.
979. W. Banks, H. Hampson, and J. Banks.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending April 26, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	
2237	1	0	2275	1	4	2284	1	1	2293	0	3	2302	0	6	2311	0	
2267	2	2	2276	0	6	2285	0	6	2294	0	7	2303	0	10	2312	0	
2268	1	5	2277	0	7	2286	0	10	2295	0	4	2304	0	8	2313	0	11
2269	1	11	2278	0	3	2287	0	3	2296	0	3	2305	0	5	2314	0	
2270	0	3	2279	0	9	2288	0	5	2297	0	3	2306	0	3	2315	0	
2271	0	3	2280	0	3	2289	2	6	2298	0	4	2307	0	3	2316	0	
2272	0	10	2281	1	4	2290	0	3	2299	0	3	2308	0	6	...		
2273	0	5	2282	0	8	2291	0	6	2300	0	7	2309	0	3	...		
2274	0	7	2283	0	10	2292	0	8	2301	0	6	2310	1	1	...		

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, May 1, 1862.

		£	s.	d.		£	s.	d.	
IRON:									
Rails in Wales and North of England	pr. ton	5	0	0	to	5	5	0	net.
Welsh Bars, in Wales	„	5	5	0	„	5	7	6	
Staf. Bars, at the Works	„	6	10	0	„	7	5	0	
„ Hoops	„	7	10	0	„	8	0	0	
„ Sheets, Singles	„	8	0	0	„	9	0	0	
„ Nail Rods	„	5	15	0	„	6	10	0	
„ Boiler Plates	„	8	0	0	„	9	10	0	
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	11	3	„	0	0	0	net
Do. No. 1, Good Brands	„	2	11	6	„	2	15	0	
Scotch Bars	„	7	5	0	„	7	15	0	
Swedish Bars, in London	„	10	10	0	„	11	0	0	
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	„	0	0	0	
Tough Cake and Tile	pr. ton	98	0	0	„	0	0	0	
Best Selected	„	101	0	0	„	0	0	0	
Australian	„	99	0	0	„	0	0	0	
South American	„	0	0	0	„	0	0	0	
Yellow Metal Sheathing	per lb.	0	0	9¼	„	0	0	0	
STEEL:									
Swedish Keg	pr. ton	15	0	0	„	0	0	0	
„ Faggot	„	16	0	0	„	0	0	0	
TIN:									
English, Block	p. cwt.	6	1	0	„	0	0	0	
„ Bar	„	6	2	0	„	0	0	0	
Foreign, Banca	„	6	4	0	„	0	0	0	
„ Straits	„	6	7	0	„	0	0	0	
TINPLATES:									
Charcoal, I.C.	pr. box	1	4	6	„	1	7	0	
Coke, I.C.	„	1	2	6	„	0	0	0	
LEAD:									
Pig, English	pr. ton	19	15	0	„	21	0	0	
„ Spanish	„	19	0	0	„	19	10	0	
Common Sheet	„	21	10	0		22	0	0	
Tea „ (Wimshurst's Patent) A special disct.	„	35	0	0	„	0	0	0	
SPELTER:									
On the spot	„	18	10	0	„	0	0	0	
For arrival	„	18	5	0	„	18	7	6	
ZINC:									
English Sheet	„	24	0	0	„	0	0	0	
QUICKSILVER	pr. btl.	7	0	0	„	0	0	0	

JAMES LAURIE, Metal Broker.
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 9, 1862.

IRON-PLATED MEN-OF-WAR.

Since the publication of the remarks which we made in our last week's number upon the iron-plated vessels which are about to be built in H. M. Dockyards from the designs of Mr. E. J. Reed, we have found that, owing to the indefiniteness of the information which has been made public concerning those designs, we under-rated their character in two important respects. We are now able to state that the armour which will be placed upon the sides of Mr. Reed's vessels will be of 4½ inches in thickness, and will be backed up with at least 18 inches of solid timber, so that it will be equal to that which has hitherto been employed in the iron-cased ships of the Royal Navy. We are further able to state that, in designing the Enterprise a moderate speed only has been secured; Mr. Reed having considered that where the speed must necessarily be limited to about 9 or 10 knots an hour (as it must be in plated vessels of the Enterprise's dimensions), it would be imprudent to sacrifice the protection of any vital portion of the ship for the mere sake of a mile an hour, or thereabouts. As we are naturally desirous (in consequence of Mr. Reed's past connection with this Magazine) to look with favour upon a great public undertaking emanating from him, we hope that the remarks which we made last week will be taken as a proof that we allow nothing to stand in the way of the independence of the criticisms which we from time to time offer upon public affairs.

We are informed that H. M. S. Enterprise, which has been commenced during the present week at Deptford Dockyard under Mr. Reed's superintendence, is the embodiment of an entirely new system of naval construction, and is even a more remarkable vessel than the American Monitor, of which the world has lately heard so much. Like the latter vessel the Enterprise has been made extremely strong in the neighbourhood of the water-line, and has also an elevated battery of guns standing up above this low shot-proof hull. But, unlike the Monitor, the Enterprise has been provided with upper works, within which ample and healthful accommodation is afforded for officers and men, and by means of which the ship has been made thoroughly sea-worthy, so that she may be sent to any part of the world. The armament which the English vessel will carry will likewise be much more powerful than the Monitor's, and each gun will have a range of fire greatly exceeding all that has ever before been obtained with ordinary broadside guns, and scarcely inferior to that which the Monitor's turret, or Captain Coles's cupola, secures; while all the difficulty and danger that attend the employment of immense revolving towers in rigged sea-going ships, are got rid of. The system of construction which Mr. Reed, the designer of the Enterprise, has developed, is applicable to ships of all sizes and classes, and while it is the first system that has rendered the construction of comparatively small sea-going fleets practicable, it is also the first which has rendered the application of extremely thick and heavy armour to our larger ships possible.

It is said, on good authority, that it is perfectly practicable to build ships upon this system which shall carry armour-plates of ten inches, or even a foot thick, and shall at the same time be armed even with the 300-pounder Armstrong guns, if Sir William Armstrong can supply them. In fact, we can see no mechanical limit either to the offensive or defensive powers which may be given, not to our coast defence vessels only, but even to our sea-going ships, if Mr. Reed's method of applying the armour where it is indispensable, and there alone, be found practicable and fully carried out. As the tendency at present undoubtedly is to increase both the thickness of our armour and the power of our guns, we may consider ourselves fortunate in having had this new system of naval construction produced just at this present crisis. It is no less gratifying to know that the new vessels will cost no more than our old-fashioned wooden vessels, excepting the mere price of the armour plates put upon them.

THE INTERNATIONAL EXHIBITION.

Lord Granville stated a few days since that a little criticism was a good thing for the Commissioners of the International Exhibition. As a commissioner, we suppose he spoke feelingly. So far the commissioners have not only been criticised a little, but a great deal, but very little good, it appears, has so far been the result. Everybody but the commissioners, and a few private friends of Captain Fowke, considers the building at South Kensington an abortion. The common sense of the multitude, and the ripened judgments of professional men and professional journals have concurred in condemning it as faulty in design, meagre in appearance, and altogether unworthy of the primary purpose of its existence. The domes appear to be celebrated for their unsightliness, their expensiveness, their inutility, and the many valuable lives which were sacrificed during the process of their erection. We believe that no less than sixteen men were killed while erecting, glazing, and painting these monstrosities. Foreign critics are now making the Exhibition building the butt of their adverse comments, their satire, and their ridicule. But, if we are not mistaken, we see evidences of an under current operation, which has for its object the vindication of the handiwork of Captain Fowke; and it is not an unlikely thing that efforts will be made to secure for him a knighthood, or some other honour. Mr. Cole says he considers the building as the creation of a great genius; and the *Athenæum* is of opinion that it is excellent, and capable of expensive adornment. That organ says it is not Captain Fowke's fault that the building is unattractive externally; but that the commissioners are answerable for the result. Had more money been expended, the building might have been made "a thing of beauty, and a joy for ever." Now it is natural for Mr. Cole, who, no doubt, aspires after the honours of knighthood himself, to sympathise with a brother aspirant. And it is equally natural for the *Athenæum* (who, most probably in this instance, is inspired by Sir Wentworth Dilke), to entertain a fellow feeling, and feel wondrously kind. Has not Sir Wentworth been recently created a baronet? A short time since the *Times* considered the building as something akin to the perfection of ugliness. But a change has come over the leading organ, and now attempts are made in its columns to show that the building is not so bad after all. We cannot imagine why these sudden changes should be effected, and why these simultaneous utterances should be made, unless some such under current influence as we have indicated is at work. Well, men inferior to Captain Fowke have recently been made knights and baronets, and sometimes inferior agencies than those to which we have alluded have been used to assist in the work. Some men thirst for no higher honour than to bask in the smiles of royalty. Their highest glory seem to consist in wearing meritricious titles, and in aping the manners and glitter of the aristocracy. In this spirit the Exhibition, up to the present moment, has been more or less conducted, and we shall not be surprised to find that a few who have been very hungry after adventicious distinction, will, by and bye, be airing their freshly earned titles in our midst.

A short time since we called attention to the absurd notice of inviting the guarantors to the opening ceremony in Court dress. We have heard of some who were adorned for the occasion, and who paraded up and down as if they were members of the "family of kings." These distinctions consisted in silk stockings, knee-breeches, badly-fitting embroidered coats, and the swords they so clumsily carried; while the immortally distinguished, like Faraday and Cobden, were the least observed of all observers. It is a little surprising, however, that the Exhibitors were not invited to send a deputation to join in the procession of the spring day. These gentlemen, who may be considered the Hamlet of the play, appear to be completely overlooked. They are treated as if they were altogether unworthy of consideration. We do not, however, think for a moment that they would have reflected honour on themselves, or on the Exhibition, had they walked about with pig-tails and cocked hats. But the corporation of the city being invited, and the guarantors being invited to send a deputation, we think that a similar compliment might have been paid to a class of men who have done more for the Exhibition than town councils, commissioners, and guarantors, put together.

A similar or a greater mistake has been made in refusing to supply each exhibitor with a season ticket. The complaint appears to be almost universal. We have heard of exhibitors of almost all positions in society emphatically condemn the arrangement. One exhibitor—a hydraulic engineer—who has expended between two or three thousand pounds in constructing apparatus in the Western Annexe, told us a few days since that he could not take a season ticket for himself, or for any one else to explain his machinery. The principal of another large firm in London also told us a day or two since that he not only could not take a season ticket for himself, or for either of his assistants, but that he could not go to the Exhibition till the shilling days commence. His firm has expended upwards of a thousand pounds sterling in assisting to make the Exhibition worthy of England. But this is not all. On account of the absence of men to explain things, the Exhibition is rendered much less attractive. A season ticket holder told us within the present week that he does not go to the Exhibition as often as he should do, because there were not more people there to explain the nature of the things exhibited. We think the commissioners should have presented, without hesitation, each exhibitor with a season ticket, and in refusing to do so, they have acted niggardly, injudiciously, and mean. There appears to exist a general impression of disappointment. It is not too late to reverse the decision, and act in a spirit of justice, we will not say of g rosity, to the exhibitors. Such a policy be the wisest, the most economical, and t satisfactory.

THE INTERNATIONAL EXHIBITION.

THE WESTERN ANNEXE.

With the commencement of the present week the public were admitted to the Exhibition on terms somewhat more in accordance with "the "times" than on the week previous, and hence the number of visitors has increased largely. It is a fact, however, that the interior arrangements are as yet by no means complete, and those who have patience to wait until "after "the 31st of May," will have the advantage of seeing a much better show at a much less cost. It was promised that at the earliest opportunity we would attempt to describe in detail some portions of the mechanical wonders to be met with in the Exhibition. That opportunity has now arrived, and the effort shall be made to redeem our promise.

The Western Annexe is undoubtedly the point of attraction to mechanical men. It is impossible, indeed, for any one who has been accustomed to the music of machinery in motion to pass along what Mr. Robert Hunt designates "the fine perspective arcades" of the Western Annexe without being himself moved. The amount of thought and labour (to say nothing of money) which have been expended in preparing that show can be fully appreciated by those alone who have been engaged in the fitting up of engines and machinery, and who are conversant with the duties of the drawing office, the pattern shop, the foundry, and the erecting department. There is not a point of minutest detail in the whole of the varied and ingenious mechanical appliances which fill the Western Annexe which has not demanded careful calculation, and the exertion of great practical skill. The curious may find an ample field for study in the peculiarities of workmanship exhibited in the machinery and tools of different manufacturers; little crotchets and quirks reveal themselves to the close observer which by the general looker-on are unnoticed. Indeed, some makers of machinery, although ever engaged in devising machines for accomplishing new purposes, or superseding hand labour, yet have their individualities so strongly stamped on their productions, that it needs no brass plate nor "spirit from the grave" to tell us whence those productions came. As the botanist does not fail to decide to what family or genus a plant belongs by an examination of its petals or its stamens, so does the initiated mechanist at once declare from whose factory came the engine, the planing machine, or the steam hammer which may be brought under his notice. We have long been aware of this mechanical idiosyncrasy, so to speak, but the idea was strengthened by our examination of the thousand and one specimens of engines and engineers' tools which fill the Western Annexe.

The steam-power which gives motion to the whole of these—or at least to those which are intended to be put in motion—is derived from a nest of boilers placed in a boiler-house beyond the Annexe, and in the rear of the conservatory of the Horticultural Gardens. The arrangement and the construction of the boilers somewhat pleased us, and it may be well to give a few particulars in reference to them. There are in the whole six boilers; these are cylindrical, and of the high pressure kind. They are each thirty feet in length, six feet six inches in diameter, and they all have double fire-places within their flues.

Ranged side by side, horizontally, at convenient distances from each other, and placed high enough and not too high for the stoker's convenience, they form a model of good boiler setting. There are no abominable stoke-holes, the temperature and dust of which stifle and choke their unhappy occupants, but all is above ground and accessible. Messrs. Hick, of Bolton, were the makers of the Exhibition boilers, and they have no reason to be ashamed of their work. So extensive is the demand made upon the steam mains—two of which traverse longitudinally each of the "fine perspective arcades" of the Annexe, in trenches made for their reception—so great is the demand made upon these for keeping the machinery moving, that the whole of the boilers have to be in use at the same time, and a pressure of not less than 70 lbs. on the square inch maintained.

Smoke-consuming fire-doors are attached to the furnaces of the boilers, but these, we believe, effect but partially the object sought. The flues communicate with a chimney of large diameter, but of low elevation at the back of the boiler-house, and the whole of the building containing the boilers with the chimney itself were completed, under the superintendence of Mr. Jacobs, in the short space of nineteen days.

This, then, is the source of power for moving the masses of machinery within the Annexe, and it would have been unwise to have omitted describing it. Of course, from the main steam arteries, in their subterranean but easily accessible beds, branch veins diverge to, and connect them with, the various engines to be put in motion, and these branches again are fitted with stop-valves, under control of the respective attendants.

It was our intention to have spoken, in the first instance, of the foreign machinery in the Western Annexe, for it would be far more gracious and graceful to do so than to bepraise our own inordinately, and have no words of kindness for the inventions of our neighbours. It is a fact, however, that much remains to be done to make the foreign mechanical branch complete, and possibly it may be well to defer remarking thereon until it be so. There are some excellent tools displayed by Zimmerman, of Chemnitz, Saxony. These are put in motion by two or three lines of light shafting, supported on columns, and fitted with drums and straps, and each machine has its price affixed. From the excellence of the workmanship about these contrivances, which, generally, are for the fitments of an engineer's shop, and their low price, we much question whether our English toolmakers will not find it difficult to compete with the Chemnitz work.

Near to Zimmerman's allotted space a locomotive of excellent construction is to be seen, and this is the work of Hartmann, also a Saxon, and located at Chemnitz. Opposite to these are portable sawing machines, invaluable to the emigrant in a wooded colony, and these are from Paris, as are some cranes in close proximity to the sawing machines.

The classification of machinery in this part of the Exhibition is well calculated for the purposes of instruction to mechanical students, and, naturally, marine engines stand at the head of the list. For compactness and neat arrangement of parts the palm must be yielded to Humphrys and Tennant's specimens, by whom engines were supplied to the British, the Brazilian, and other Governments. This firm have evidently studied with success two of the most important points in connection with engines for war steamers and screw propulsion; they have compressed the greatest amount of power into the least possible compass, and contrived so that they shall be placed out of harm's way in the depths of the hold. The pair of 400 H.P. engines by Maudslay, Sons, & Field, for H.M.S. Valiant, again, is another proof of the talent of the eminent firm in question. We believe that the Messrs. Maudslay had not the slightest idea, up to within a short time of the opening of the International Exhibition, that these engines were to be placed within it. They were being prepared for the ship for which they were intended, and by no means got up for show at Kensington. Whatever of merit, therefore, may pertain to the workmanship of the Valiant's engines, is the genuine and legitimate result of Messrs. Maudslay's usual excellence in this branch.

Todd and Mac Gregor's direct acting inverted cylinder marine engines have many striking and excellent points about them, as well as some of a peculiar character. Of the last description, is that arrangement by which the two cylinders are made to work vertically over the crank shaft. This firm is remarkable for the general finish and beauty of the work leaving its hands, and the pair of engines now referred to constitute a gem in these respects.

Messrs. George Rennie & Sons, of London and Greenwich, exhibit a pair of marine screw engines for H. M. S. Reindeer. These are of 200 H.P. nominal, and are precisely similar to those of H. M. S. Perseus, a sister vessel. They may be denominated single trunk engines, and for compactness of arrangement rival any in the Exhibition. The projecting trunk, objected to by many, is absent in Rennie's engines, while they have the advantage of a long connecting rod, which one misses in those of Humphrys and Tennant, before referred to. The cylinders are placed close to the condensers, and thus a good vacuum is likely to be ensured. The bottom bearing of the connecting rod, too, is easy of access—a practical point, which those who are acquainted with the working of marine engines will know how to appreciate. The slide valves are double ported, and the pressure of steam at the back is relieved by an arrangement first introduced into marine engines by Messrs. Rennie. These engines are simple in construction, and at the same time possess great strength. They are, therefore, apparently well calculated for the hard work contingent on constant steaming in long voyages. Similar engines are in actual use, we believe, in H. M. Navy, as well as in those of the Russian, Mexican, Chilian, and Italian governments. The only war steamer as yet possessed by the British colonies—the Australian steamer Victoria—has a pair of similiar engines. The same firm are engaged in the construction of a large pair of engines for the Peninsular and Oriental Company. These are on the combined, or high and low pressure principle, and are to have a superheating apparatus and boilers on Lamb's patent plan. It is unfortunate that these engines, which combine the very latest improvements in marine engineering, are not in the Exhibition. Travelling for a few minutes from the Western Annexe, we find that in two other classes the Messrs. Rennie are represented by models of the following kind:—One of the 14 double-screw gunboats, made by them for the Spanish Government for the suppression of piracy in the Pacific. A model of one of the 10 double-screw gunboats constructed for the East Indian Government, and used for river service during the mutiny. There are also models of the celebrated steel gunboats made by the Messrs. Rennie for the Russian Government, and used against the pirates of the Caspian Sea. These boats draw only 20 inches of water, and are thus enabled to pursue sea robbers into the shallowest creeks and inlets of the Caspian.

The double-screw system of propulsion adopted in the Rennie gunboats is being applied to the new American Stevens' battery, and also in the French gunboat Tortue recently built. A model of a caisson for the Austrian arsenal, at Pola, in the Adriatic, is shown, as well as one of a 50-H.P. tug-boat for the government of Isabella 2nd of Spain.

Perhaps, however, the most interesting models of the Rennie group are those of a portion of the gigantic floating dock, constructed by the firm for the arsenals of Cartagena and Ferrol in Spain, and of an armour-plated frigate, shown in Section 2, and in process of being docked. A very clear idea of the ingenious construction of the floating docks is conveyed by this model, as a part of the outer skin or plating is, as it were, removed, to shew the pumps, sluices, and machinery employed in raising and lowering the dock. Such a description of floating dock is palpably very simple in its formation, and yet may be easily made so strong, both laterally and longitudinally, as to prevent the possibility of straining a vessel when placed upon it. We can conceive that it is admirably adapted for parts where there is not much rise and fall of the tide, or a river where there is a very rapid current. The dock now actually in course of erection at Rennie's works, at Greenwich, has been inspected and approved by the Duke of Somerset and several officers of the French Marine.

In another class of the Exhibition is to be seen a model of an extension of the Rennie system of docking as it is now being carried out at Cartagena. It consists of flat shallow slip-ways, so arranged that vessels may be hauled off the floating dock on the land, and thus the dock itself may be made available for docking many vessels in immediate succession. This operation has, indeed, been effected at the arsenal of Cartagena, and among the vessels so docked was the celebrated frigate Novara, which had just completed the circumnavigation of the globe on behalf of the Austrian Government.

In the absence of dock accommodation, so often and so disagreeably felt by the British Navy, and which will be still more felt when our iron fleet becomes a reality, it is much to be desired that so simple a method of docking and undocking as the Messrs. Rennie present should be largely adopted by the Government. At many of the colonial and foreign stations, for example, what would be more advantageous than to be provided with dock accommodation of this character? On the west coast of America there is no kind of facility for docking vessels, nor is there any means of doing so in the West Indies between Havana and Rio Janerio. At home, too, there are several naval stations where a floating dock would be found an invaluable auxiliary. The first naval lord has lately been to Malta for the purpose of looking to its dock accommodation, and it is to be hoped that while looking to the construction of iron-plated ships the Admiralty will not overlook the means of repairing them.

We have somewhat digressed from the immediate subject of the International Exhibition, but one of the great objects of that display is to lead us on to suggestions of a practical nature, and which may tend to the public advantage. If the courts and aisles of the palace of industry and art, with their rich and varied contents, are to be regarded only as a show, why then there is little use in their having been prepared at all, and the money and labour lavished in furnishing them had better have been expended in some other way.

Next in order of disposition in the Western Annexe are to be found machine tools of every kind, and wood-working machinery of very ingenious construction. Perhaps, in the first rank of tool-makers may be placed Whitworth, of Manchester, and in that of machinery for performing operations upon wood for building and other purposes, Worssam, of Chelsea. The ingenuity displayed in the construction of machines for morticing, turning, planing, and dressing wood generally is, indeed, something marvellous. It is true that Bentham and Brunel were the pioneers in this direction, but it is equally true that they have not found many followers until Mr. Worssam stepped into the field, and, no doubt, he will "marshal "others in the way that they should go." The machines for dealing with metals in the Exhibition represent most fairly and completely those employed in the engineering establishment of the United Kingdom, and they undoubtedly display an amazing amount of ingenuity.

If such men as Smeaton and Rennie, and others of the same school, could only look into a modern engineer's shop, they would, indeed, be astonished at the progress which has been made since their day in the tool department. The hammer, the chisel, and the file constituted the main appliances for carrying on work when they flourished, but now we have changed all that, and machines are made which do all but think and speak, and that, perhaps, is beyond their capabilities. Cotton spinning machinery of the most exquisite delicacy figures largely in the Western Annexe; while, by way of contrast, we have sugar mill work of the most massive description. All alike testify to the skill of the artizans of Britain, and demonstrate that nothing is too minute, nothing too ponderous to be dealt with, and successfully dealt with, by them. Where so many exhibitors have excelled, it seems almost invidious to particularise, and the feeling engendered by a view of the machinery in the Western Annexe is simply one of pride, strongly mingled with admiration. The rapid strides made in mechanical science since this magazine came into being—now some forty years since—is immense. What would a "western annexe" have been filled with in 1820, for example? And what an interesting thing would it not be if it were possible to establish a department in the Exhibition in which the steam engines, machines, tools, and general mechanical appliances of that time could be shown by way of contrast with the present magnificent display! Then, again, if a road waggon, a stage-coach, and a locomotive, were placed side by side, how eloquently would they not speak of progress and improvement! It is, perhaps, a misfortune as regards the International Exhibition, that none of these startling comparisons were tangibly instituted. They are more instructive to young minds than any other mode of inculcating knowledge. If Stephenson's "Rocket" were placed beside the locomotive of Sharp, Stewart, and Co., or that of the North Western Railway Company, or of Sir William Armstrong, how unmistakably would it tell of what thirty odd years of railways have done for us, in a mechanical sense! Such were some of the reflections which passed through our mind while going through the "fine perspective arcades" of Mr. Hunt, and gazing on the mechanical treasures stored within them. It is possible that some day the suggestions we venture to throw out with regard to *Comparative Exhibitions of Mechanical Science*, may be realised. When this season shall have passed away, and the vast building which has challenged and obtained so much hostile criticism shall remain as a casket whence the jewels have been abstracted, it may come to be a consideration as to how it may thereafter be employed, and then may comparative schools be opened therein.

Occupying a very small space in the Western Annexe are some machines which are the precursors of a revolution in one extensive branch of tool manufacturing, and these are the file-cutting machines of the Manchester File Making Company. It has been maintained obstinately for many years past that the manufacture of files was beyond the machinists' art. Hand labour alone could produce them, it was said, and in Sheffield it was stoutly declared that hand labour alone SHOULD produce files. At length the problem seems to be solved—the delusion dissipated; and from what we see of the file-cutting machines in the Exhibition, and know of their performances in Manchester, we are bold to say that the days of hand file-cutting are numbered. The importance of this change can scarcely be over-estimated, as the price of files will be reduced enormously by it. The Sheffield workers will have to succumb to the giant might of automatic machinery, as other classes of workers have been compelled to do, and the sooner they accept the alteration of system the better will it be for themselves.

We have left ourselves little space to touch a hundred other topics which crowd upon our attention and claim notices at our hands. It is embarrassing thus to find so rich a mine of mechanical wealth as the Exhibition affords, and not be able to work it at once more effectually; but again and again shall we return to the task, nor leave it until justice has been done to those who have created it.

THE ARMSTRONG GUN.

In the official report of proving the great muzzle-loading Armstrong gun at Shoeburyness, a few days ago, it is called a 300-pounder, proved as a smooth-bore. This loose style tends to mislead; it conveys the idea that the gun is a 300-pounder, which is not true, for it is only a 150-pounder. The pretext for calling the gun a 300-pounder is that when rifled it is intended to carry a 300 lb. bolt—the shot will be elongated to double its present length, and will be increased to double its present weight. But the gun is not now a 300-pounder. When rifled, it must be proved again, and when that takes place it will be seen whether it will stand the proof of the increased strain of the explosive force on the metal augmented by the increased weight of the projectile.

This customary exaggeration of the *Times* reporter, of which this is a specimen, deceives the public. It is an artifice to puff and bolster up the Armstrong Company too transparent not to be palpable to the initiated, but unobserved by the general readers. It helps to support a fallacy, and protect it from too close a scrutiny by acting on the imagination. A report is current, that on examining the great gun after the proof which took place with 70, 80, and 90 lbs. of powder, a long fissure was discovered in the chamber. We think it fair to mention the rumour, to give the authorities the opportunity of contradicting it if unfounded.

THE COMPETITIVE RIFLE GUNS.

On the 18th of October last we called attention to a competitive list of rifle guns, which the late Lord Herbert had instituted, and we gave the results of the experiment up to that date. We hope by next week to be in a position to report the official termination of these long series of trials. The successful competitors appear to be Mr. Lancaster and Mr. Bashley Britten. Mr. Lancaster's gun has withstood one thousand rounds, eight hundred of which were with solid, spiral, oval p [illegible] weighing 50 [illegible] lb Mr. Britten' [illegible] times, with 48 lb. projectiles, and 5 lbs. powder charge. Both guns are still perfectly serviceable. We think it most desirable that the guns having successfully withstood so severe a test, should now be fired with the same weight and description of projectile, but with 10 lbs. charge of powder; the important object to be solved being which kind of rifling, and description of projectile, is best adapted for high velocities. This is the most important question of the day in reference to naval artillery.

POWER OR SPEED FOR THE NAVY.

In our columns of to-day will be found the letters of two valued correspondents who are partizans of "speed." But "power" does not lack its advocates. We see from the New York correspondence of the *Morning Star* the rapid progress of the Federals in creating an iron-clad navy, which shows that the first thought of the constructors is invulnerability. The *Times* declares "it is no longer of any "avail to argue that iron-plated cruisers can-"not be rendered 'sea-worthy.' The answer "is that cruisers unless they are iron-plated "will be worth nothing whatever." But to render this axiom a truth the prime condition must be added—every cruiser, every ship for home or foreign service, must be armour-clad—not partially, but completely—over the whole of her exposed surface, and in the most efficient manner to resist not only hollow projectiles, but the heaviest solid shot at high velocities. Every vessel not so protected will be at the mercy of the vessel that is. In other words, power must be maintained, even if speed be sacrificed. We hold this point to be no longer doubtful, and at the same time of such vital importance, that we shall never cease to advocate the principle, until it is accepted as the fundamental law for the reconstruction of our navy.

We are the more induced to take this course by the numerous letters we receive from all classes, including members of both Houses, thanking us for the independence and impartiality with which we publish our own views, and those of our correspondents.

Government, we observe with pain, are determined to make a stand for the Spithead Forts. Let them be warned in time, lest their patriotism be suspected, lest it be thought that rather than abandon contracts in which great private interests are involved, rather than lose the patronage afforded by the maintenance of vast shipbuilding establishments, they would saddle the nation with a heavy and objectless expenditure, culpably neglecting the true system of national defences. If ministers do not act with candour they will convert this issue into a party struggle. By persisting in applying to detached forts and land fortifications the funds so urgently demanded for floating batteries, they may raise a storm of indignation for which they are not prepared. We see the signs of the times, and so does the leviathan of the press.

This naval armour question is assuming colossal proportions,—it threatens to absorb for the moment every other topic, and it is not wanting in political significance. On reliable authority we may affirm the Americans within twelve months will have an iron-clad fleet of forty sea-going ships afloat, all of which might cross the Atlantic. We know the formidable preparations and state of advancement of our neighbours. We mentioned last week what Russia is doing. We are not alarmists; but we cannot shut our eyes to facts, and we see ground for uneasiness when we know that three great maritime States, earnestly intent on providing themselves with formidable armour-plated fleets, look to power in the construction of their ships, whilst we look to speed. As our correspondent, "A Civilian," has taken up the question of "power or speed" with much detail, we will for the future leave that subject in his hands.

We cannot close this article without alluding to the notice given by the Minister at War that a further loan will be demanded by Government for coast fortifications. This announcement means that ministers, regardless of the significant hint they received from the House of Commons, persevere in the Spithead forts scheme. It is a bold attempt in defiance of public opinion; but if the Members, who extorted a promise from the Premier that the works should be suspended, are at their posts when the motion comes on, there is no danger that the attempt will succeed. If the Chancellor of the Exchequer prefers the loan system to meet the expense of coast defences, a loan for floating batteries will be cheerfully granted. There is no sound reason for borrowing money for land forts, and not for floating batteries. The loan plan, however dressed up by the ingenious Chancellor, is a mystification to keep the sum from swelling his budget. In either case the interest must be paid. Let Mr. Gladstone lay aside all prudishness, and if the nation will grant a million or two for *iron walls*, let him take the money by way of loan.

Ministers must have set their hearts on those Spithead forts, if we are to judge by the petulance of the Premier in snubbing the House for interfering with the administrative duties of Government. It is hard to draw the line where counsel ends and administration begins. A real combat between two iron-cased ships, no doubt, caused a sensation, and gave a check to the War Department. Suddenly a new hope sprung up in the performance of the 150-pounder Armstrong; but if the account of the break-down of the gun at the proof be true, that hope is gone; and the House, if not the Defence Committee, may think it wise to wait till great guns which will not burst are constructed, before forts are built to receive them.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER XI.

I am pleased to find from numerous communications addressed to the Mechanics' Magazine that the purport of my letters is beginning to be appreciated, and it shall not be my fault if their object is not accomplished. This I need hardly say is to induce the authorities to emerge from the trammels of routine, to put down favouritism in the trial of plans for the construction of our iron walls, and, above all, to disseminate reliable information on a novel question little understood, but of the first importance to our national existence. You have been pleased to submit to my notice a number of letters which mine have given rise to, and I have in every case expressed my opinion upon them with impartiality to the best of my ability. Those of Mr. E. J. Reed and Mr. T. Moy claim especial attention; the former in particular, on account of his letter to the *Times*, which, as well as Mr. Moy's letter, appears to me so replete with fallacies which ought to be answered, that I make them the principal topic of this letter, to the exclusion of other matters, which must wait till next week. There is a singular similarity in Mr. Reed's and Mr. Moy's arguments, which would lead one to think they are advanced intentionally in support of each other, but I do not believe that to be the case; I attribute their community of ideas to the fact of their being disciples of the routine school which regards naval architecture as a profound science, that none but the initiated can fathom, and out of the sphere of the civil or manufacturing engineer. I am of a different opinion in giving expression to which most of the observations I am about to offer will apply to both those gentlemen indiscriminately.

Mr. E. J. Reed, the champion of "speed at any price," and the protégé of the Admiralty, has taken you to task somewhat sharply for a statement you conceived it to be your duty to publish with reference to his plan of composite ships, with iron upper works and wooden bottoms. He asserts that there is no foundation for your statement that "his system of iron plating will afford "protection against hollow projectiles, but will not "be of sufficient strength to keep out solid shot." I have no doubt when the proper time comes the Mechanics' Magazine will justify itself for giving publicity to that statement. But I have to deal with Mr. Reed's own statements, and unless he repudiates the paragraph in the *Times*, which first announced his plan, and tells us that we are to place no reliance on his own letter, and the article which appeared in that journal on the 1st of May, I will show from those publications that the statement which Mr. Reed calls a *delusion*, is literally true. I am moreover persuaded that he, as well as the Admiralty, will soon discover that his idea, when it comes to be ventilated, of fast sea-going ships to be constructed by an incongruous combination of wood and iron, will, in the opinion of others of more influence and authority than myself, be looked upon as a delusion so dangerous to the nation, that it will never be carried into effect.

In the changing round of passing events which distracts the daily press, a mechanical fact is forgotten. But here is a fact for the naval engineer of such supreme importance to our maritime preponderance, that I shall continue to hold it up to public notice until it is understood by our legislators, or until a competent commission is formed to investigate in all its bearings the vast and complicated question of iron-clad ships. Mr. Reed, and other projectors, who urge the authorities to adopt their schemes without complete and searching enquiry, I hope will understand that in my strictures on their proposals I am influenced only by a sense of duty; and if my opinions find a place in the Mechanics' Magazine, nobody better than Mr. Reed knows the independence and pertinacity with which that publication allows opinions on engineering questions of public interest to be maintained in its columns when it believes those opinions to be right.

When a scheme of great pretension is propounded with mystery, and an unlimited demand is made on people's faith, they are naturally led to seek in the internal evidence of the description of the plan, so far as it is made known, some clue to its real character. Mr. Reed, "*reserved*" as he has been, unconsciously lets us into the whole of his secret.

I will first call attention to the following paragraphs, in which Mr. Reed, with deliberate care and forethought, states his own case. "A step of great "importance in the existing state of our naval "affairs has just been taken by the Board of "Admiralty. It is well known that at the present "moment our entire fleet of small vessels of war is "built of wood and is wholly unprotected by "armour plating. Every corvette, sloop, and gun-"boat in the service is liable, therefore, to "*sudden and complete destruction by the shell "fire of an enemy*. They cannot, we know "perfectly well, be *protected all over*. At "length, however, a method of construction "has been devised, which is said to afford great "security with a *comparative small amount of "plating*." The plan, we are then told, provides for the "protection of the guns and vital parts," namely, "the boilers, engines, magazine, rudder, "head, and steering apparatus." In the first paragraph Mr. Reed honestly opens his mind; he is involuntarily betrayed into a disclosure of the foregone conclusion which is the basis of his plan. Our small vessels of war must be protected from *sudden* *and complete destruction by the shell fire of an enemy.* He provides for the protection of the "vital parts" and has recourse to a comparatively small amount of plating. Now, we ask, is not this a plain admission that these small vessels are to be only *partially* protected, and that after providing for the protection of the "vital parts," the armour plating of the other exposed parts will only keep out shell?

Is Mr. Reed prepared to show that this is not a correct description of his plan? I wait for his reply, but I shall not be satisfied with a general disclaimer. I wish for information on the following points:—What will be the thickness of the armour-plates to his gun shields, and other vital parts, to the entire surface above the water line, and between wind and water; and will his plan provide a bomb proof deck and render the entrance of incendiary shells through hatches and ventilation openings impossible?* He may answer these questions without betraying his secret of construction, and without compromising the great interests of the country, which on one occasion he thinks may be jeopordised by a premature disclosure of his plan, whilst on another he treats very lightly any proposition for the immediate construction of coast defence vessels. Of these he derisively expresses "his humble "opinion that they have far too many advocates "already," and comforting us with his "dare say" that we shall "know how in the *hour* of danger "to produce scores of Merrimacs and Monitors." Thus, according to Mr. Reed, there is so much danger to our cruisers and ships of war on foreign stations, that it is important to conceal his plan from other countries even *for a few weeks;* whilst we may placidly defer for months, until the danger is upon us, the construction of floating batteries for the defence of our ports and arsenals.

Will Mr. Reed explain how it is that in his opinion "the real danger to England *at this crisis* "is that of letting her permanent power upon the "sea pass heedlessly away from her, by neglect-"ing her sea-going navy," and that he seems to regard himself as her tutelary angel, by stepping in "to avert this calamity." I confess I am bewildered at this picture, and it must be imagined Mr. Reed is in possession of some daring scheme of an enemy, prepared to swarm the seas with fast-going iron-clad vessels, which, of a sudden, will pounce upon our timber-built cruisers. In this matter he leaves us in the dark, but for my part I will confess I am incredulous. *There is a crisis,* no doubt, but to my simple understanding, looking at the nature of the preparations of our next door neighbour, and our cousins over the water, if there is a "calamity to avert" it would be the destruction of our arsenals and of the ships in our ports and rivers. But let us not be frightened into a repetition of the Warrior blunder by a "bugaboo," whether it be raised by Mr. Reed or any other sanguine inventor. The Lords of the Admiralty, however, seem to have been more impressionable, for Mr. Reed, with grateful enthusiasm, informs us that "nothing in the shape of "routine was allowed to obstruct his plan." Happy Mr. Reed! where did he find the key to the portals of routine? Thrice happy, I should say, for not alone has the official barrier opened at his call, but his invention is adopted, and he has got an appointment. To be sure he is amongst friends and brothers, fellow-disciples of the school of naval construction and advocates of wood. Verily, Mr. Reed must be the envy of inventors, who have in vain besieged the doors of the Admiralty for months and years.

In sober seriousness, are the destinies of the country to be entrusted to a projector who promulgates such inconsistent and contradictory views? Are we to be thus lulled into security at home, and told that the formation of a partially protected fleet of fast-sailing cruisers for foreign service should be the first object of our solicitude, when other nations are devoting their energies to construct invulnerable armour-plated ships which would speedily destroy these half protected vessels if the latter did not avail themselves of their speed to keep out of range?

In describing his plan, Mr. Reed makes an ugly admission—the ship's bottom will be *combustible.* What will be the result of an incendiary shell piercing any weakly plated part, or dropping into the hold? In a few minutes the timber would be in flames and the destruction of the ship inevitable. The advocates of "iron at any price" have reason on their side, and can afford to accept that definition of the principle they stand by. Nothing gives greater force to their theory than the fact of the *incombustibility* of a ship built entirely of iron. Much might be said on the score of the repairs these wooden bottoms would require, of which the expense would be much enhanced by the greater tendency to decay at the line of connexion between the two materials. Of this Mr. Reed, as a naval architect, must be thoroughly convinced. One of the advantages of iron ships is the saving of repairs, to which economists naturally attach much importance. It is the chief ground of hope of a reduction of the Naval Estimates, to which Mr. Reed's scheme would give a death blow.

Mr. Reed, I fear, is not quite satisfied with the reception his plan met with in the columns of the *Times*, an article in that journal having pointed out with some humour that he maintained it would be "an obvious advantage" to employ some wood in the construction of ships, not because it would improve their structure, but because "the "shipwrights of the Royal Dockyards needed em-"ployment, to say nothing of the timber in store "there." A notable argument this;—we are to perpetuate the worst part of a condemned system, by using timber for that portion of a vessel most subject to decay, that we may use up an old stock, and give work to hands which need employment. Mr. Reed's commiseration no doubt extends to the officers of the constructive department, whose occupation will be gone when wood ceases to be used as a material in shipbuilding.

Mr. Moy's letter is written in a tone of candour and moderation, which evince the sincerity of his convictions, and I am sure when he has read my explanations he will perceive the real meaning of the terms of depreciation applied by me to naval architects. It is easy to misconceive a writer when the precise sense in which words are used to express things is not defined. Nine-tenths of the fiercest controversies have no other foundation than the misconception of the meaning of a word.

I use the term architect in the sense of a designer, and I have in my mind a class of designers of the old school, whose early instruction and subsequent studies have been directed to the construction of wooden ships; I come to the conclusion that a naval architect of that class is not a naval constructor, and is by habit so indoctrinated in the routine of the wood system, that he is no authority in iron shipbuilding, and can have no pretension to be regarded as an engineer. An able builder of timber vessels would not by his experience be the right man to entrust with the construction of an iron ship, which requires a much greater extent of constructive and engineering knowledge than he can possess. I believe that to be a correct definition of the class of architects who designed the Warrior and Defence, and also of the projectors and *patrons* of the new class of vessels proposed to be constructed with iron above water and wood below. I agree in every word Mr. Moy writes as to the occupation of "engineer" and "naval architect" merging into each other. It is precisely my argument, and it is that union of the two professions which I consider indispensable to constitute a naval constructor, whom, to be more intelligible, I prefer to call a "naval engineer." That is the professional embodiment which is the requirement of the Iron Shipbuilding Art, and I am of opinion that it is more likely to be produced by grafting the naval designer on the engineer, than the reverse. Because I consider a designer, or draftsman (and many so-called naval architects are nothing but draftsmen) require a much lower order of talent than an engineer. I make no doubt that an intelligent engineer, who was master of the theory and practice of his arduous profession, if he devoted his attention to iron ship building, and called in the aid of a naval designer, might become a first-rate naval constructor; but I do not believe that any amount of study would convert a naval designer of the old timber school into a naval engineer. Mr. Moy properly describes what a naval constructor ought to be. In my censure I referred to certain naval architects who were mere theorists, have no experience as constructors of iron ships, and affecting to despise those who are not adepts in lines and curves and computation on paper, arrogate to themselves a supremacy they do not possess. But, nevertheless, those are the men to whom the reconstruction of the navy in iron on engineering principles which they do not understand is entrusted. To this cause I attribute the many failures of the Admiralty.

I am surprised a writer of Mr. Moy's intelligence should so misunderstand a plain statement as to illustrate my idea of the value of power above speed by a comparison between a "tub" and a fast frigate. My meaning clearly is, "do "not sacrifice power to speed; make power, "not speed, the *prime* condition. By all means "obtain all the speed you can, but let power be "your ruling principle. In this new kind of "naval structure the first law is invulnerability, "which you must obtain, whatever class of ships "you build." Of course there must be classes, some for home, some for foreign service. For every class get all the speed you can, consistently with the required weight of naval armour. If you want a Warrior, do what Russia has done—give up one or two knots for complete protection.

To give point to his attack on "A Civilian" for undervaluing naval draftsmen, Mr. Moy advances suppositious cases, which do not illustrate my ideas, but are the offspring of his own imagination. I propose we should have fighting frigates or liners, fast-sailing cruisers, and floating batteries, and I wish to give to each class the greatest possible speed consistent with invulnerability. I would have neither "tubs" nor "plungers," but in no class would I have the vessel exposed to certain destruction by partial or inefficient protection. If a daring "Gloire" or "Couronne" visited our coasts, I would have a bold "Warrior" to give her battle, but it should be a "Warrior" of the improved Russian build, whose extremities should not be liable to be shot away, and whose entire exposed surface should be efficiently protected with armour plates, whose log, in fine, should never record the disgrace to her captain and crew, which Mr. Moy recommends, *that she used her speed to run away from an adversary.* At the same time I would have floating batteries in every important port and roadstead so perfectly invulnerable, and carrying so heavy an armament, that even a Russian "Warrior" should not be a match for them.

A Civilian.

INVENTORS AND THE INTERNATIONAL EXHIBITION.

An Act for the Protection of Inventions and Designs exhibited at the International Exhibition of Industry and Art for the Year One thousand eight hundred and sixty-two. 29th April, 1862.

Whereas it is expedient that such Protection as is hereinafter mentioned should be afforded to Persons desirous of exhibiting new Inventions or new Designs at the International Exhibition of Industry and Art to be held in the present Year, under the Direction of "The Commissioners for the Exhibition of 1862:" Be it enacted by the Queen's most Excellent Majesty, by and with the Advice and Consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the Authority of the same, as follows:

1. This Act may be cited for all Purposes as "The Protection of Inventions and Designs Amendment Act, 1862."

---

[*] Some of these questions are answered in another column. Ed. M. M.

Protection of new Inventions.

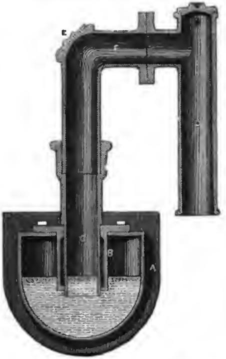
2. The Exhibition of any new Invention at the said International Exhibition shall not, nor shall the Publication, during the Period of the holding of such Exhibition, of any Description of such Invention, nor shall the User of such Invention, under the Direction of the said Commissioners, prejudice the Right of any Person to register provisionally such Invention, or invalidate any Letters Patent that may be granted for such Invention.

Protection of Designs.

3. The Exhibition at the International Exhibition of any new Design capable of being registered provisionally under the Designs Act, 1850, or of any Article to which such Design is applied, shall not, nor shall the Publication during the Period of the holding of such Exhibition of any Description of such Design, prejudice the Right of any Person to register provisionally or otherwise such Design, or invalidate any Provisional or other Registration that may be granted for such Design.

N.B.—We see this Act provides for the protection of inventions exhibited against the consequences of publication, but it confers no priority in inventions exhibited over the same inventions if provisionally protected by other parties. We therefore beg to call the especial attention of exhibitors to this fact, and we advise them to take Provisional Protection for such inventions as they desire to secure to themselves.

COCKEY'S GAS APPARATUS.

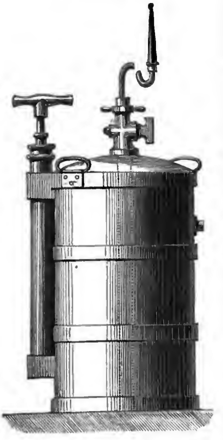


This invention, just patented by H. & F. Cockey of the Frome Foundry, Somerset, relates to a peculiar arrangement connected with those parts of the apparatus employed in the manufacture of gas for lighting, known as the "dip pipe" and "hydraulic main," and its object is to allow for the contraction and expansion of the ascension pipe, and thereby to prevent the strain upon the joints of those pipes, and upon the mouth-pieces of the retorts.

The patentees propose to fix in the hydraulic main a short flanch pipe, as represented above, sufficiently long to give the necessary seal for the dip pipe; this pipe is bored out so as to allow the dip pipe to pass through it. The outside of the dip pipe is to be turned to fit the short pipe truly, but allowing it space to shift easily through it as the ascension pipe expands or contracts. In fixing the pipes, the lower edge of the dip pipe should extend about a quarter of an inch below the outer pipe.

A is the hydraulic main, and *B* is the short flanch pipe projecting therein, and dipping into the water of the main, so as to seal the pipe; *C* is the dip pipe, which passes freely through the short pipe *B*, so as to be capable of rising or falling therein as the ascension pipes *D* expand or contract. A door *E* is fitted to the upper part of the dip pipe for facilitating the cleaning thereof, and of the branch *F* leading to the ascension pipe.

TONGUE AND GREER'S PORTABLE FIRE ENGINE.



The apparatus illustrated above is a portable fire engine recently patented by Messrs. Tongue and Greer, of Liverpool. It consists of a cylindrical shaped air-tight vessel, formed with a dome-shaped top, having a pipe passing through the centre, and extending down nearly to the bottom of the interior of the vessel. The head of the pipe above the top of the vessel is fitted with a stop-cock and a suitable screwed collar for attaching the nozzle pipe, or the end of an air pipe of an air pump, by means of a union nut. At the side of the vessel a small tap is screwed for allowing the escape of air during the time of charging the vessel with water. The vessel is charged with water through the vertical pipe, the air in the vessel being allowed to escape as the water rises. When the water has risen to about two-thirds or three-fourths of the height of the vessel, the tap is closed. By means of the pump the required quantity of air is forced into the cylinder to be acted upon by the water.

The Madrid Academy of Sciences offers, among other prizes, one for the solution of the following:—To determine the probable errors implicated in topographical plans deduced from two photographic perspective views, taking into account all the sources of error that may possibly exist. The prize will consist of a gold medal, and the sum of 6,000 reals ($150.) The papers written in Spanish, or in Latin, must be addressed to Don Aguilary Vela, perpetual Secretary of the Academy of Sciences, Madrid.

THE INDIAN PRODUCTS AT THE EXHIBITION OF 1862.

By M. C. Cooke, F.S.S.

It is impossible, within the limits of two or three columns, and at this early stage, to do justice to the Indian collection, superior as it is to that Department in 1851, and interesting beyond the Exhibitions of either 1851 or 1855, from the closer association of India with the British crown. In the event of a continuance of the civil war in America, and an untoward success to the rebel arms in China, we are taught by the present Exhibition that India *can* supply us with cotton, tobacco, and tea, sufficient to compensate us for the deficiencies which those events might occasion. what may be necessary to ensure such a supply does not fall within our province at this juncture to indicate. The fact that three hundred samples of tea are shown, and more than a hundred of cotton, with some tobacco, are features not to be forgotten in passing through the Indian collection.

Starchy products, though not numerous, present two or three novelties. A kind of arrowroot from a plant growing wild in Cuttack is of very good quality. The manufacture has been but recently introduced into that province, and is conducted in a remarkably simple manner. This product, which is known in the bazaars under the name of *Palvoa*, is collected by the Sabars and made into cakes, or boiled with milk, and used as an article of food. The plant which produces it grows abundantly in the jungles, and might be cultivated with very little trouble. It is at present uncertain what this wild plant may be.

From Akyab, another kind of arrowroot has been sent, which is known under the native name of *Rembowah*. It is said to be prepared from a root called Pemban Oo, which is obtainable in large quantities, and the cost of the article when manufactured would be about four rupees per maund.

From Chota Nagpore we have also a similar product, obtained from a wild jungle plant; and from Chittagong, "wild ginger starch." The wild ginger grows abundantly everywhere in Chittagong, and is with difficulty eradicated from the soil. The present specimen is only an experimental one, but as the supply of the root is unexhaustible, and the process of manufacture simple, there seems no doubt that, if found to be a valuable product, a large quantity might be obtained at a price below that of Arracan rice.

Behchandee is prepared by the Gonds, and is sold in the bazaars of Jubbulpore. It is not an arrowroot, but bears some resemblance to it when pounded. The natives prepare it for food in a variety of ways, and use it on fast days. It is obtained from the stems of a jungle-plant, after being soaked in running water for several days.

Elastic Gums, though not exhibited in great profusion, contain also some novelties. From Gorruckpore, four samples of Caoutchouc are sent, which are stated to be obtained from sources new to commerce, though what those sources may be has not transpired. From Chingleput, Dr. John Shortt contributes india-rubber, obtained from the Mudar plant (*Calotropis gigantea*), and also from the milk-hedge (*Euphorbia antiquorum*), and another species of Euphorbia (*E. tortilis*). Amongst the gutta-percha of the Malayan Peninsula will be found a substance greatly resembling it, called Gutta Terbole, and which it affirmed to be employed, not only as a substitute, but as an adulterant of the genuine article. What Gutta Gree Grip and Gutta Babee from the same locality may be, we have not yet had the opportunity of determining. Somewhat allied in its uses is the Buglar tree bark, from Chota Nagpore, where it is employed as a glue for joining wood.

Soluble gums and Resins are similar to what have been exhibited on former occasions; Gum Kino, from Rangoon, probably the produce of *Pterocarpus Wallichii*, might be obtained in almost any quantity, the tree which yields it being one of the most abundant. Of oleo-resin, the turpentine of *Pinus longifolia*, and wood-oils, are most important; of the latter, several kinds are exhibited. The Gurgun of Chittagong is obtained by cutting a hole in the tree, about three feet from the ground, and about four or five inches deep into the tree. The base is hollowed out to retain the oil. The hollow is cleared with fire, without which no oil exudes. After it is cleared the oil issues, and is removed as it accumulates. The oil is thus extracted year after year, and at times there are two or three holes in the same tree. The oil is allowed to settle when the clear part separates from the thicker portion. If a growing tree is cut down and cut in pieces, the oil exudes, and concretes on the stem and the ends of the pieces, very much like camphor, and with an aromatic odour. A tree yields from 250 to 400lbs yearly, and the same tree will yield for several years. This substance has been employed as a substitute for Balsam of Copabia, and would be useful as a varnish. It can be had in any quantities, at ten rupees per maund.

In the oil series, and amongst oil-seeds, are some deserving notice, but to which we cannot at present refer, except by directing attention to the Nahor oil, obtained from the seeds of *Mesua ferrea*, and the oils of *Aleurites triloba*, and *Rottlera tinctoria*. Although the latter are not new oils, they are both worthy of a better appreciation in this country. The curiosities in this section are the oil of cocoa-nut shells, and the veritable oil of Macassar. Attars and essential oils belong rather to the second-class (Pharmaceutical products), which is so fully represented, that we dare not attempt indicating objects of interest.

The dye-stuffs will attract attention on account of the presence amongst them of the Roum dye of Assam, *Ruellia* leaves, a series of illustrations of the green dye of Malda, with cloths dyed therewith, and a similar series illustrative of a new yellow dye, from the same locality, which can be obtained in any quantity. The flowers of *Trapa bispinosa*; *Thitna* dye, from Akyab; *Neepa* dye, of Burmah; *Kamla Goondee*, of Cuttack; *Jackwood*, of Akyab; and *Mug* dye, of Chittagong, are amongst the novelties in this section. A series of sixteen linches are contributed from Darjeeling, but these require testing before anything can be affirmed as to their tinctorial properties. An interesting book is shown from Nepaul, containing specimens of colours obtained from native dyes, but unfortunately barren of information. Two or three new tanning substances are exhibited from Chittagong and elsewhere.

The stimulants, whether alcoholic or narcotic, are well represented; amongst the former, we notice rice arrack, Mowha spirit, Mango whiskey, prepared from the Mango fruit, and cane-juice spirits. Amongst the latter, *Gunjah*, *Bang*, and varieties of *Churrus*, or hemp resin. Full illustrations of the manufacture of opium, with specimens of the product. *Bynee* seeds, used as a substitute for Betel-nuts. Tobacco from a few localities, and other narcotics amongst the medicinal products.

The grains and pulses are more numerous than ever, and in connection with these, Dr. Forbes Watson exhibits a series of the chief varieties, with the results of his analyses attached, showing the nutritive value of each.

Textile materials must not now be ventured upon, and the same may be said of woods, of which latter there are from twelve to fifteen hundred specimens.

Amongst the curiosities of food, we have, in addition to the usual contributions of shark's fins, bird's nests, trepang, agar-agar, &c., some potted fish gnapie, dried mushrooms from China, dried fungi, and other delicacies.

It was not our intention to note anything of mineral or animal products, or articles of manufacture of any kind, but simply to point out amongst the raw products of the vegetable kingdom such as by their novelty or interest deserved attention, but even in this limited field we do not find it so easy to execute our desire, and on the day that this passes into our readers' hands they will be enabled to judge for themselves whether our Indian possessions do not deserve to be considered as the most brilliant jewel in the British crown.—*The Technologist.*

MORE LARGE AMERICAN GUNS.

The Pittsburg *Chronicle* says:—"We understand that the Navy Department has orderd the casting of fifty 15-inch Dahlgrens at the Fort-Pitt Works, in this city. The draughts for the moulds, &c., have been prepared by Captain Dahlgren, and it is understood that the guns will be much shorter and thicker than 15-inch Rodman gun. Most of them will be smooth bored, and are designed for use on board the new vessels, of the Monitor style, and others, whose construction has been already directed by Secretary Welles. These guns will weigh, in the rough, over seventy thousand pounds each, and will carry a ball weighing over three hundred pounds. They will doubtless be ready by the time the vessels for which they are intended are completed." The *Scientific American* says:—"One of Rodman's fifteen-inch guns was successfully cast a few days ago at the Fort Pitts Works in Pittsburg. This is the third casting made of these guns, and the work will soon be regarded as an every-day performance. The process was as follows:—The rough casting in the pit weighs about 78,000 pounds, and nearly forty tons of metal were melted for the purpose in three furnaces. The furnaces were fired about five o'clock, and at eight minutes past ten the first furnace was "tapped." A line of troughs or "runners" had been laid from the furthest furnace, some eighty feet, the second furnace, about midway, joining in, and the two streams, emptying, with that from the first furnace, into a large cauldron at the edge of the pit, from which two streams diverged, and, passing around the pit, emptied into the gun on opposite sides of the core barrel. The furnaces were tapped in succession, and nearly all the metal allowed to run out before the next in order was opened. At twenty-four minutes past ten the mould was filled, in just sixteen minutes from the opening of the first furnace, showing that the metal must have poured into it at the rate of nearly two and a half tons per minute.

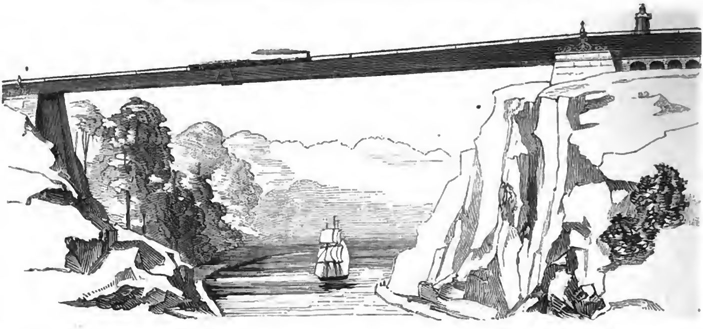
HARBOURS OF REFUGE.

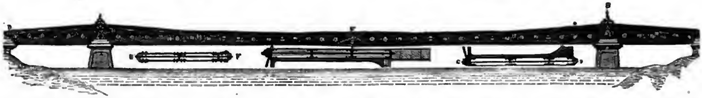
We have frequently had occasion to call attention to the comparatively defenceless condition of our coasts, in reference to our commercial marine as a nation. We pay great attention, and much money to protect ourselves from the attacks of foes that may never come, but we treat with comparative indifference foes which visit us periodically, and strew our shores with wrecks. It cannot be denied that our foes are very inadequately provided with harbours of refuge. In the House of Commons on Tuesday last, Mr. Lindsay moved a resolution, "That it is the duty of Her Majesty's Government to adopt measures to carry into effect the resolution of the House of the 19th of June, 1860, in regard to harbours of refuge." He complained that, notwithstanding the vast increase in the tonnage of shipping resorting to our ports, and the number of ships and of valuable lives lost on our shores since the resolution was adopted, nothing had been done to carry it into effect; and he computed the value of the property—to say nothing of life—which had been sacrificed through the want of harbours where vessels, foreign as well as national, could find refuge. The motion was seconded by Admiral Duncombe. Mr. Baxter said he hoped that neither the House nor the Government would sanction the motion. He dwelt upon the large sum proposed to be expended upon these works, observing that the more he compared the report of the Royal Commissioners with the evidence the more he was convinced that they had taken too sanguine a view of the utility of harbours of refuge in the saving of life, and of the necessity of some of the harbours they had recommend. He appealed to facts in support of his objections, and warned the House to be cautious before pledging itself to an expenditure which would, he believed, be far greater than any benefit that could be derived from it. Sir F. Smith, in supporting the motion, replied to the objections of Mr. Baxter, and asked, what was the use of a vote of that House if it was not to be acted on? It was our coasting trade, the nursery of our seamen, which it was the object of the resolution to protect. Lord A. Vane Tempest, Mr. Pease, Mr. Blake, and Mr. Baines spoke in favour of the motion.

Mr. M. Gibson observed that everybody must agree in the general proposition that harbours of refuge were desirable things; but this did not go far to throw light upon the particular proposal of Mr. Lindsay, or upon the question whether the House should pledge itself to a large expenditure to carry out certain particular works in a particular part of the United Kingdom. He did not admit that the Government had overlooked the resolution of 1860. It was said they had done nothing; but they had done a part, and a very important part, of what the Commissioners had recommended—namely, the improvement of trading harbours by the advance of money on loan. The Government had brought in a Bill, founded upon that identical proposition, which the House had adopted, and which had been acted upon; but it was fair to give a new scheme time to work. The Commissioners proposed to expend 4,000,000*l.* upon the harbours they recommended; but he believed the works could not be done under 8,000,000*l.* This money must be provided by Parliamentary grants, and the House must devise ways and means to meet this additional expenditure. He adduced instances, contained in a long list of loses of ships and lives, in which harbours of refuge could be of no use whatever, contending that, if the House agreed to the resolution, little would be done to prevent the loss of life complained of. It was the duty of the Government, therefore, to look narrowly into the proposed scheme, and, in his opinion, no case had been made out for the House pledging itself to carry it out; on the contrary, he believed it would be unwise to adopt it.

Mr. Liddell argued strongly in support of the motion, remarking that the Government had adopted only a secondary recommendation of the Royal Commissioners. Sir M. Peto blamed the manner in which the Government had dealt with this question; they should have submitted a plan to the House in furtherance of its resolution. Sir J. Pakington observed that this subject was a national one, involving the commercial interests of the country, and the House had facts before it in evidence of the serious loss of life and property, the reports of a committee of that House and of a Royal Commission, and a vote of the House in favour of harbours of refuge; and, with respect to the cost, Mr. Gibson had set aside the calculations of the Commissioners, and substituted his own loose conjectures. Sir G. Lewis said it was vain to regard this as a question in which the Government alone was interested; it was one of responsibility of the House of Commons, involving the expenditure of a large sum of money, which could be met only by additional taxation or by loan. This was the question for the House to decide, not what it was wished to be done if there was money ready in the Exchequer. He thought it would be a most rash and precipitate step for the House to assent to the motion. Mr. Bentinck said he should confine himself to the financial part of the question, and was bound to admit that that had materially changed since an increased demand had been made on our financial resources. He could not, however, vote against a motion founded upon principle of humanity. Mr. Crossley supported the motion. He thought the difficulty of ways and means should not prevail in a question of life and death. The money might be borrowed on terminable annuities. Sir F. Baring cautioned the House against listening to proposals for raising money by loan in time of peace—a course which, when once begun, it would be difficult to stop. Sir S. Northcote spoke shortly in opposition to the motion. After a reply by Mr. Lindsay, the motion was negatived upon a division by 115 to 77.

SEDLEY'S BRIDGES IN IRON AND WOOD OF LARGE SPANS.





BRIDGES IN IRON AND WOOD OF LARGE SPANS.

The rapid and vast extension of railway enterprise has caused a demand for bridges and viaducts of immense spans, as a means of communication and connection over rapid and wide rivers, valleys and gorges. Consequently, during late years the subject has engaged the attention of many of our most celebrated engineers.

It is only necessary to reflect upon what has been done within the last forty years, to be convinced of the importance of the question. Starting with the great iron-master, Wilkinson, who first conceived the idea that cast iron was a suitable material for bridges, and who, with the assistance of the great Telford, constructed the first remarkable bridge in that material; we pass on to a series of names of highly fitted scientific men, each of whom has left his mark graven on the face of the land.

Associated with these great works are to be found the names Melcalf, Smeaton, Telford, Brindley, Rennie, Sir Samuel Brown, Rendel, George and Robert Stephenson, Brunel, father and son, Vignoles, Roebling, and Oudry, the span of whose contemplated bridges seems almost fabulous.

Passing in review the performances of these men, each of whom has chosen his own method of construction, it is remarkable that nearly all have arrived at the completion of bridges of large spans, with the lightest weight of metal compatible with strength and security for the proposed traffic.

The astonishing achievements of these engineers have stimulated the inventive genius of many others, who, by the elucidation of new ideas, and the absorption of old ones, have endeavoured to produce bridges of immense spans. Amongst these is Sedley, a mechanical engineer, who has introduced to our notice a bridge of his invention, which seems, in addition to great span, to have lightness, rigidity, and weight-carrying properties. The model is a very simple affair to look at, and almost as simple in construction. As far as regards the bridge, we will let the inventor speak for himself. He claims in his patent for a bridge which can be constructed of wood or iron, or wood and iron and steel combined. One of the new features of this bridge is that the suspension forms a part of the tubular construction, and is entirely independent of the piers or abutments, and forms no part of them, and so differs entirely from any bridge that has hitherto been built or attempted. On other points there is also a marked difference. The inventor proposes to build his bridge on shore on a suitable tram or railway, and when completed and fairly tested, to launch it out as far as desirable over the abutment, always reserving on shore a sufficient part or portion to counterbalance fully the part projected out. In bridges up to 500 feet span, the inventor proposes to build the bridge entirely on one side of the river or valley intended to be crossed, and then to launch it out over the river or valley till the projected end is received on the abutment on the other side or shore of the said river, &c. But when the spans exceed 500 feet, he proposes to build one half of the bridge on each shore, and, when completed, both are run out intermediate of the width of the river and united in the centre by means of the shoe *S* shown in the sketch. The centre is also further strengthened by the application of arched flanged girders *M M*, which are made of great strength, consistent with lightness, and for this purpose it is proposed to use steel, or iron and steel combined. Great economy and simplicity are claimed for this method of construction, as no subaqueous piers or works are necessary, and single spans up to 1,500 feet in width can be constructed at any height without risk or difficulty, as the work may be tested daily whilst in progress. In the diagram shown of the bridge it will be seen that it is composed of a series of long rectangular girders piled on each other, varying in size and thickness according to their distance from the centre of the bridge. The roadway is suspended by means of bars passing through the centre of these girders. The suspension bars or plates *H* perform only a limited office in the place of the usual catenery curve.

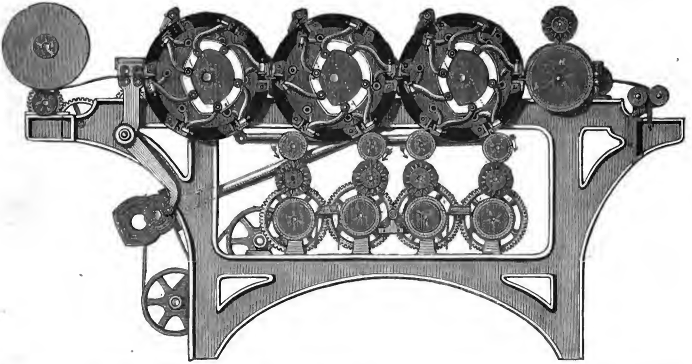
Sections of the girders over the piers are shown at *A B* of the in-shore end at *C D*, and of the middle *E F*. It is quite evident that in this method a bridge of single width may serve a double purpose and be useful for ordinary and railway traffic.

Models of these bridges on a scale of 60 feet to 1 foot, and 28 feet long, and weighing 24lbs., may be seen at the International Exhibition, Museum of Patents, South Kensington, and Architectural Museum, Conduit-street. Engineers will be allowed to test them without reserve, having first agreed upon the weights such structures ought to bear.

WHIPPLE AND STAFFORD'S MACHINE FOR COMBING COTTON.

Messrs. Whipple and Stafford, of Providence, U. S. A., have recently patented in this country a machine for combing cotton and other fibrous material. The machine is constructed in such manner that successive tufts are taken from the sliver of material to be combed; both ends of each tuft are combed on each side of the fibre, and the tufts are deposited in such manner that they overlap one another and are reunited into a continuous sliver, the noils and waste being made to pass off at a different point from the machine. The material to be combed is for this purpose fed to the machine through feed rollers mounted on arms, which are pivoted to the machine, and which are made to oscillate at stated times. Successive tufts of the material are taken from these rollers by means of a number of nippers arranged at equal distances apart around a common axis, the jaws of the nippers being parallel to the axis. Six nippers are, by preference, employed; as represented in the above engraving, the fixed or stationary jaws of the nippers are fixed at their ends to two discs, which can turn on the axis around which the nippers are arranged; the moveable jaws of the nippers are carried by arms

WHIPPLE AND STAFFORD'S MACHINE FOR COMBING COTTON.



which turn on pins fixed to the discs; the moveable jaws have also fixed to them other arms, on the ends of which are rollers which work in a grooved cam fixed on the axis. Six notches or recesses are formed in the peripheries of the discs, and the discs are rotated with a step-by-step motion, by means of clicks or pawls on arms fixed to the axis, entering the notches, a to-and-fro motion being given to the arms. The cam on the axis is so formed that as each nipper is brought opposite to the feed rollers the jaws of the nipper will be open; the end of the sliver is then inserted by the feed rollers between the jaws of the nipper as the arms on the axis move back, so that the clicks or drivers upon them may enter fresh notches in the discs; the jaws of the nipper are closed by the partial rotation of the cam, and the end of the sliver will thus be held by the nipper, and when the feed rollers move back the nipper will retain a tuft of the fibrous material; at the next partial rotation of the discs the next nipper will be supplied with a tuft of fibrous material, and in like manner all the nippers will in succession be filled. As the nippers are, by the rotation of the discs, brought round to the point opposite to that at which they are supplied with a tuft, the jaws of the nippers are, by the action of the cam, caused to open at the end of the backward motion of the arms; the end of the tuft which before was projecting from the nipper will then be held by one of another set of nippers, arranged in like manner to that above described, around another axis parallel to the first axis; a step-by-step motion is given to this second set of nippers in like manner to and at the same time as the first set, so that each of the second set of nippers will in succession be filled with tufts from the first set. Each of the second set of nippers, after it has received a tuft, will, at the next partial rotation of the discs carrying the second set of nippers, bring the tuft into a position to be acted on one of its sides by a rotating cylinder covered with card or other combing teeth, which will comb one side of the free end of the tuft; at the next partial rotation of the discs the tuft will be brought into a position to be acted on by another cylinder rotating in the opposite direction to the first cylinder; this second cylinder will comb the other side to the free end of the tuft; at the next movement of the discs the tuft will be brought opposite to the point at which it was taken hold of by the nipper carrying it; this nipper will then deliver the tuft to one of a third set of nippers arranged and worked in a similar manner to the two former sets; this nipper will hold the clean end of the tuft. When the nipper is moved one step it will bring the free end of the tuft into a position to be cleaned on one of its sides by a card cylinder, and at the next movement of the nipper the free end of the tuft will be cleaned on its opposite side by another card cylinder; the tuft is now perfectly combed, and the next movement of the nipper will bring the tuft opposite to the point at which it was taken hold of, and the nipper will then deliver it on to a doffer or cylinder covered with teeth, and in like manner each of the third set of nippers will in succession deliver a perfectly clean tuft on to the doffer; the tufts being made to overlap each other, the overlapping tufts are removed from the doffer in the usual manner in the form of a continuous sliver. The rotating cylinders which clean the tufts have the noil removed from them by means of rotating cylindrical brushes, which deliver it to doffers from which it is taken in the ordinary manner. The arms, which are fixed to the three parallel axes, and which carry the clicks or drivers which give the step-by-step motion to the discs carrying the nippers, are, at their lower ends, pin-jointed to a bar to which a to-and-fro motion is given by a crank; this to-and-fro motion of the bar causes the axis of the arms to make a partial rotation, first in one direction and then in the other, and gives a to-and-fro motion to the ends of the arms carrying the clicks or drivers, and the step-by-step motion is thus simultaneously given to the discs carrying the three sets of nippers. The feed rollers are, as before stated, carried on arms pivoted to the machine, and on the axis which carries the arms is another arm, on the end of which is a roller which works in a grooved cam on the crank axis, which gives motion to the bar above mentioned; this cam is so formed as to give the required to-and-fro motion to the feed rollers at the proper times. Instead of three sets of jaws, two only can with advantage be employed, but in such case each tuft would have the end that was detached from the sliver first combed: it has, however, been found that a better result is produced by combing the tuft first in the direction in which the fibre is naturally laid.

REMARKS ON AMPERE'S EXPERIMENT ON THE REPULSION OF A RECTILINEAR ELECTRICAL CURRENT ON ITSELF.[*]

By Mr. James Croll.

To the Editors of the "Philosophical Magazine and Journal."

Gentlemen,—In the Philosophical Magazine for February last, Professor van Breda, of Haarlem,[†] describes an experiment wherein, in order to show that the movement of the conductor in the experiment of Ampère is not due to the influence of angular currents, he suspends the conductor above the mercury, and allows the currents in the latter to pass underneath. A current which was found to be more than sufficient to move the conductor when floating upon the mercury, according to Ampère's experiment, was made to pass through the apparatus; but not the least motion in the suspended conductor could be observed, and he therefore concludes that the motion of the conductor in the experiment of Ampère cannot be due to the influence of angular currents.

It is remarkable how Prof. van Breda did not observe that a motion of translation in the case of his suspended conductor was absolutely impossible; for he allows his conductor to cross the currents in the mercury; and the consequence, of course, is, the currents in the mercury repel the one half of his conductor and attract the other half; for instance, they attract the perpendicular parts, and repel the horizontal part D D. If Prof. van Breda were to cut his conductor asunder at the points where they intersect the currents in the mercury, and by some contrivance or other still allow the current to pass, he would find that the horizontal part would be instantly repelled, and the perpendicular parts instantly attracted; but when the whole is in one rigid piece, as in his apparatus, no motion can possibly take place.

Granting that the conductor is moved by the repulsion of the current on itself, still it certainly must be admitted that Ampère's experiment cannot prove the fact; for if we admit, in regard to his experiment, that the same motion under exactly the same conditions ought to take place from the influence of angular currents, then, when the motion does take place, we have no warrant to conclude that it is *not* due to angular currents, but to some other cause.

---

[*] From the Philosophical Magazine.

[†] In a note recently received from Prof. Logeman, of Haarlem, we are informed that his name should have been associated with that of Prof. van Breda as joint author of the communication here referred to.—Eds.

The inference is the same whether the conductor be composed of solid copper or of fluid mercury; for the motion does not depend upon the nature of the conductor, but simply upon its position in relation to the impelling current.

If we reverse the direction of the points of the conductor, as Prof. van Breda has ingeniously done, the conditions of the experiment are entirely changed; for then Ampèrian repulsion and angular currents act in direct opposition to each other, and we are then at liberty to decide, from the direction of the motion which actually takes place, to which force the motion ought to be attributed.

I do not see how it follows, as Prof. van Breda and others seem to suppose, that, because two currents at all possible angles affect each other, they *must* do the same when they are both on the same straight line; because if they act only in *right* lines from their *sides*, no effect can possibly take place when they are both on the same straight line. In this case a *curved* line would be required to produce the effect

The experiment of Prof. van Breda with the reversed conductor, and some others detailed by him, certainly prove that the molecules of a conductor, while the current is passing, do repel each other; but still this fact does not appear to settle the real question at issue; for it does not follow that, because the molecules of the conductor along which the current passes recede from each other, the contiguous parts of the current itself repel each other. Our conceptions of the nature of the electric current, as well as the facts from which these conceptions are derived, are in direct opposition to this conclusion.

Whether we view electricity as a substance or merely a dynamical affection of the ordinary molecules of matter—in fact, whatever our views of its nature are, it will be admitted that the electric current is an effort of forces to regain a state of equilibrium. The fact that a current is passing along a chain of molecules is a proof that these molecules are not statically in the same condition. This fact has been proved experimentally by Kohlrausch, in his investigations into the laws of Ohm. The differences in their statical condition are the immediate causes of the current; for the current is simply the discharge of the electricities of the contiguous molecules upon each other, so as to bring them under the same conditions. What, then, are the mutual tendencies of molecules thus differently charged? Is it to approach or to recede from each other? Prof. van Breda and others reply, facts show that they do recede from each other. Be it so; still we must allow that the electricities with which the separate molecules are charged do not recede. If the molecules themselves recede, the electricities approach; for it is the tendency of the electricities on the contiguous molecules to combine which produces the current. The contiguous sections of the *current* must therefore attract, not repel each other. It may be difficult to conceive how a mutual attraction of the contiguous sections of the current should result in a mutual repulsion in the contiguous molecules of the conductor carrying the current; but if such be the fact, this is enough.

The difficulty will, however, in a great measure disappear when we reflect that the molecules offer resistance to the transference which constitutes the current, the amount of the resistance depending upon the nature of the molecules, the conductibility of bodies for electricity being inversely as the amount of resistance offered by their molecules. Now, if the current is produced by a tendency in the electricities on the contiguous moleclues to combine, then it is quite natural to suppose that the molecules themselves would recede from each other in order to prevent combination. Their very endeavours to resist the transference of their electricities would cause them to recede from each other. If we suppose that the molecules are not simply passive, but active in their resistance (and we have every reason to believe that they are), then recession from each other, when the current is passing, is what might be anticipated.

The same conclusion will follow should we suppose that the passing of the current tends to produce a disturbance in the equilibrium of the molecules; for each molecule, in its endeavour to avoid disturbance in its statical condition caused by the presence of its neighbour, will recede from it. In fact, recession is implied in the very idea of molecule resistance.

I am, Gentlemen,
Your most obedient Servant,
James Croll.

Glasgow, March 4th, 1862.

Erratum.—In last week's Number, abstract "2390. R. Aytoun," for *Patent abandoned* read *Patent completed.*

Proceedings of Societies.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, Feb. 14,—Rev. John Barlow, M.A. F.R.S., Vice-President, in the Chair.

William Olding, M.B. F.R.S. Sec. Chem. Soc., On Mr. Graham's Researches on Dialysis.

Vial Diffusion.—When an open vial, filled with a solution of some salt or other substance, is introduced into a jar of water, a portion of the disolved salt passes gradually from the vial into the external water. This portion is known as the *diffusate.* The diffusates yielded by different substances under precisely the same circumstances vary greatly. Thus, common salt yields double the amount of diffusate that Epsom salt yields, while Epsom salt diffuses twice as rapidly as gum arabic. Every substance has its own definite rate of diffusibility in the same liquid medium, according to the nature of the medium,—whether water or alcohol, for instance. The diffusion of any particular salt is scarcely affected by the presence of a different salt, though materially effected by the presence of the same salt in the external liquid. The general law seems to be, that the velocity with which a dissolved salt diffuses from a stronger into a weaker solution is proportional to the difference of concentration, *quoad* that salt, between the contiguous solutions. The phenomena of liquid diffusion are manifested most simply and uniformly when dilute solutions only are employed.

Jar Diffusion.—When the solution of the salt to be diffused, instead of being placed in a vial, is conveyed by means of a pipette to the bottom of a jar of water, the dissolved salt gradually rises through the superincumbent water to a height or extent proportional to its diffusibility. The results of jar diffusion bear out generally those of vial diffusion. They show, moreover, the absolute rate or velocity of the diffusive movement. Thus, during a fourteen days' aqueous diffusion from ten per cent. solutions of gum-arabic, Epsom salt, and common salt respectively, the gum-arabic rose only through $\frac{7}{14}$ths of the superincumbent water, or to a height of 55·5 millimetres; while the Epsom salt rose through the whole $\frac{14}{14}$ths of superincumbent water, or to a height of 111 millimetres; while the common salt not only rose to the top, but could have risen much higher; seeing that the uppermost or 14th stratum of water into which it had diffused, contained about fifteen times as much salt as was contained in the uppermost or 14th stratum of water into which the Epsom salt had diffused.

Diffusive Separations.—If a solution containing equal weights of common salt and gum-arabic be poured into a jar of water, the ratio of salt to gum in the dilute liquid in the jar will be the same as in the original solution. But if the original solution be poured into a diffusion vial from which the dissolved compounds can diffuse into a jar of water, for every 100 milligrammes of salt, about 22½ milligrammes of gum will pass out into the external water; or the ratio of salt to gum in the dilute liquid in the jar will be as 100 to 22½, instead of as 100 to 100, or a separation of the gum from the salt to the extent of 77½ per cent. will have been effected. Again, when a solution containing five per cent. of common salt, and five per cent of Glauber's salt (the diffusion-rates of which salts are to one another as 100 to 70) is submitted for seven days to the process of jar diffusion, the upper half, or $\frac{7}{14}$ths of superincumbent water, will be found to contain 380 milligrammes of common salt and only 53 milligrammes of Glauber's salt; or the ratio of common salt to Glauber's salt in the upper half of the liquid will be as 100 to 14, instead of as 100 to 100, or a separation of the Glauber's salt from the common salt to the extent of 86 per cent. will have been effected. Not only the partial separation of mixed bodies, but the partial decomposition of definite chemical compounds may be effected by diffusion. Thus when alum, which is a double sulphate of the two metals, potassium and alluminium, is allowed to diffuse from its aqueous solution, the diffusive tendency of potassium compounds being much greater than that of aluminium compounds, a portion of sulphate of potassium actually breaks away from the sulphate of alluminium with which it was in combination, in order to diffuse into the external or superincumbent water more freely than the sulphate of alluminium can.

Crystalloids and Colloids.—Diffusibility does not seem to be associated in any definite way with chemical composition. Thus, the complex organic bodies, picric acid and sugar, have much the same diffusion-rates as common salt and Epsom salt respectively. Isomorphous compounds, however, are for the most part equi-diffusive, but the groups of equi-diffusive are larger than those of isomorphous bodies. The common salt group, for instance, includes not only chloride, bromide, and iodide of sodium, which are similar in composition and insomorphous in form, but also nitrate of sodium, which is dissimilar in composition and heteromorphous in form. But in comparing highly diffusive substances on the one hand, with feebly diffusive substances on the other, one broad dissimilarity becomes apparent, namely, that highly diffusive substances affect the crystalline state, while feebly diffusive substances are amorphous, and, in particular, are characterized by a capability of forming gelatinous hydrates. Hence the distinction established by Mr. Graham between highly diffusive bodies, or *Crystalloids,* and feebly diffusive, or *colloids.* There are very many compounds which can exist, both in the crystalline and gelatinous states, and which present two distinct diffusion-rates corresponding respectively thereto.

Nature of Diffusion.—Liquid diffusion may be attributed to a self-repulsion of the particles of salt or other body which diffuses on the one hand, and of the particles of water or other liquid into which it diffuses on the other; or it may be attributed to a particular kind of mutual attraction existing between the particles of the salt and of the water. Assuming the truth of this latter hypothesis, it is clear that the diffusive attraction of crystalloid particles for water is greater than that of colloid particles; and, recognising this superior diffusive attraction of saline particles, it is conceivable that a salt should be able to unite diffusively, not only with free water, but also with water that is already in a low form of combination, as it exists in a soft solid, for instance, such as jelly; and this is found to be the case. Common salt, for example, diffuses into a mass of solid jelly almost as easily and extensively as into a similar bulk of *free* water. But although the introduction of a gelatinous substance does not interfere in any appreciable way with the diffusion of a crystalloid, it arrests almost completely the diffusion of a colloid body. The colloid has but very little tendency to unite diffusively, even with free water, and is quite incapable of abstracting and uniting diffusively with water that is in any state of combination, however feeble.

Dialysis.—Although a simple diffusion into water can effect the partial separation of a highly diffusible from a feebly diffusible substance, yet a much better result may be obtained by causing the diffusion to take place, not into free water, but into or through the combined water of a soft solid, which, as before observed, scarcely affects the diffusion of crystalloid, but almost arrests that of colloid bodies. When a piece of vellum, or of membrane, or of parchment-paper, or even a layer of mucus, is interposed between a colloid solution and a quantity of water, the colloid, in order to get to the free water, must pass through the membrane, that is to say, must unite diffusively with the combined water of the membrane, which it is incabable of doing. The crystalloid body can pass through, but the colloid cannot. This constitutes *dialysis,* which means the separation of crystalloid from colloid bodies, through a membrane that will allow the passage of crystalloid, but will not allow that of colloid particles, Because the crystalloid particles, having a highly diffusive power, can unite diffusively with the combined water of the soft solid septum, so as to reach the external free water; whereas the colloid particles, having a very feebly diffusive power, cannot. The process of dialysis is altogether different from that of filtration. Filtration refers to the passage of masses through appreciable pores, but in a dialytic septum there are no pores, and the movement is not molar but molecular. The dialytic septum will allow chemical action to take place, or that low form of chemical action which constitutes diffusion; but, being quite impervious to the mechanical passages of liquid, it will not allow of filtration.

Colloid Solutions.—The solution of various colloids has usually been effected heretofore by means of crystalloid chemicals, comprising acids, bases, and salts. By dialyzing these liquids, the crystalloid reagents diffuse away, and leave the colloid bodies in simple acqueous solution. Mr. Graham has thus obtained pure colloidal solutions in water of numerous mineral and organic substances, such, for instance, as silica, tin-stone, alumina, hæmatite, chrome, Prussian blue, prussiate of copper, sucrate of copper, and other sucrates, tannin, gum, caramel, albumin, &c. These colloidal solutions are for the most part unstable. Either spontaneously, or on the addition of a very minute quantity of some or other crystalloid reagent, they pectize, or become converted into solid jellies. Hence Mr. Graham speaks of two colloidal states, the *peptous,* or dissolved, and the *pectous,* or gelatinized. Colloid bodies are characterized by their non-crystalline habit, by their low diffusibility, by their chemism inertness, by their high atomicity, and above all by their mutability. All these properties are exceedingly well manifested by colloid silica, or co-silicic acid. Its 5 per cent. acqueous solution, obtained at once by dialysis, is quite transparent and mobile. It may be boiled in a flask, and considerably concentrated, without undergoing any obvious change, and even a 14 per cent. solution is perfectly limpid. But in common with other colloidal solutions, that of silica, after a longer or shorter time, according to its purity and dilution, becomes opalescent and viscous, and eventually sets into a firm insoluble jelly, capable, however, by a certain treatment, of *peptization*, or re-solution. The jelly of silica gradually shrinks and oxudes pure water. When dried *in vacuo*, over oil of vitriol, it forms a transparent, glassy, but not anhydrous mass. The residue left by its ignition has a specific gravity of 2·2, that of crystalline silica being 2·6. There is reason to believe that, in process of time, the gelatinous form of silica may pass spontaneously into the crystalline form. The *pectization* of acqueous co-silicic acid can be produced at will. When the solution is boiled, for instance, in an open vessel, a ring of insoluble silica forms round the margin of liquid, and causes the whole to gelatinize. Again, the addition of a solution containing even $\frac{1}{10000}$th of any alkaline or earthy carbonate, effects an almost immediate *pectization*. Aqueous co-silicic acid gives gelatinous precipitates with several colloid solutions, those of peroxide of iron, alumina, gelatin, and albumin, for instance. Its action on gelatin closely resembles that of tannin, which is a similar colloid acid. Thus a piece of skin, immersed in a weak solution of co-silicic acid, becomes after a time thoroughly tanned, or converted into leather; and the process of tanning with co-silicic acid further resembles that of common tanning, in the very gradual manner in which the combination takes place, and in the indefinite character of the compound produced.

MEETINGS FOR THE WEEK.

MON.—*Soc. of Engineers*, "On the use of Coal in Furnaces without Smoke," by F. Young, Esq., at 7 p.m.
Geographical Soc., I. "Description of the Ruins of Cassope, in Epirus, near Preirsa," by Lieut.-Col. T. B. Collinson, R.E. II. "British Columbia," by William Kelly, Esq. III. "Explorations in Vancouver Island," by Commander R. C. Mayne, R.N., at 8.30 p.m.

TUES.—*Inst. Civil Engineers*, I. "On the Malta and Alexandria Cable," by H. C. Forde, Esq. II. "On the Electrical Tests employed during the Construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables," by C. W. Siemens, Esq., at 8 p.m.
Royal Inst., "On Ancient Art," by C. T. Newton, Esq., at 4 p.m.
Zoological, at 9 p.m.

WED.—*Society of Arts*, "On Gold Mining and the Gold Discoveries made since 1851," by John A. Phillips, Esq., at 8 p.m.
Lord Ashburton's *Soirée* will be held at Bath House, Piccadilly.

THUR.—*Royal Inst.*, "On Some of the Chemical Arts, 1851, 1862," by Dr. Lyon Playfair, C.B., at 3 p.m.
Antiquaries, at 8.30 p.m.
Architectural Association, "On Painting in Spain," by F. Y. Hurlstone, Esq., at 8 p.m.
Royal Soc., at 8.30 p.m.

FRI.—*London Inst.*, "On the Classification, Properties, and Uses of Plants," by R. Bentley, Esq., at 7 p.m.
Royal Inst., "On the Iron Walls of England," by J. Scott Russell, Esq., at 8 p.m.
United Service Inst., "On Military Training," Sequel to a Lecture delivered March 8th, 1861, by Lieut.-Col. A. C. Robertson, at 3 p.m.

SAT.—*Royal Inst.*, "On Agricultural Chemistry," by Prof. Anderson, Esq., at 3 p.m.

M. Genin lately addressed the Academie des Sciences on the subject of "The Sex of Eggs." He affirms that he is now able, after having studied the subject for upwards of three years, to state with assurance that all eggs containing the germ of males have wrinkles on their smaller ends, while female eggs are smooth at the extremities.

MACHINERY FOR PRINTING CALICOES.—An idea may be formed of the extraordinary influence which the introduction of machinery and improvements in engraving have had in cheapening the cost of printed calicoes, from the statement made by Professor Calvert, of the United States, that large furniture patterns, such as are required for some of the oriental markets, and into which sixteen colours and shades enter, would have cost formerly from 7 dols. to 9 dols. per piece, because they would have required sixteen distinct applications of as many different blocks, and would have required more than a week in printing, whereas the same piece can now be printed in a single operation, which takes three minutes, and costs about 1 dol. 50.

TO CORRESPONDENTS.

Received.—J. C. M., Amateur, "Short Circuit" (next week), J. C., E. C., J. B., "Practical" (next week,) D. and L., R. Bros, C. B. K., J. N., J. P., H. H., Capt. C., Capt. N., W. T., Capt. S., A. G.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

IRON-PLATED VESSELS OF WAR.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I must beg to offer a most unqualified contradiction to the statement contained in your last week's article, to the effect that the system of armour-plating to be adopted by me "will afford protection against hollow projectiles, but will not be of sufficient strength to keep out solid shot." Such a statement is wholly unauthorized, and must have been made in total ignorance of what my plans really are. The writer has not been more fortunate in his statement of my views concerning the speed of war ships—a subject upon which I generally prefer to guide myself, to a great extent, by the wishes of our most able and experienced naval officers.

I may say of the entire article, what the article says of my *supposed* views, viz., that it is "*only* a delusion."

Very truly yours,
E. J. REED.

POWER OR SPEED FOR THE NAVY.

SIR,—Having been a close observer and attentive student, *con amore*, for more than twenty years, of all naval and engineering matters, I beg a little space to enable me to say a word or two on the above subject.

The occupations of "Engineer" and "Naval Architect" appear to me to merge very much into each other, and, for myself, I never took the trouble to ascertain where to draw the line; for a naval architect requires no small share of engineering ability, and an engineer attempting to build a steam vessel requires more knowledge of the sea than merely its specific gravity. I am therefore surprised at the small value which "a Civilian" places upon the professional knowledge of the naval architect.

The Americans in the midst of a desperate internal struggle, have got a couple of iron cased craft which would be considered a great disgrace to our Admiralty; and because, in the construction of these wretched makeshifts, they have ignored speed, our Admiralty are expected to ignore speed also. If our authorities were to commence, in real earnest, to build a fleet of slow iron tubs, we should soon hear that the Americans had discovered the necessity of *speed*, and forthwith England might begin another reconstruction, in which the professional knowledge of the naval architect would be considered of vital importance.

Your readers will probably remember the behaviour of the Agamemnon in 1858, with the telegraph cable on board, in a gale in the Atlantic; her form and behaviour on that occasion would be repeated again and again, if the advice of "a Civilian" were to be taken; and a short vessel entirely covered with armour from end to end in a heavy sea, would deserve the name of "the plunger." Your readers will also remember that the Niagara was in the same gale as the Agamemnon, but her long bow enabled her to weather it with far greater comfort and freedom from danger than the other vessel.

Suppose a vessel to be built with a jolly round bow, and ditto stern, armour-plated entirely, and fitted with engines consuming only 2 lbs. per indicated horse power. First of all, her bad form is far more extravagant than the very worst engines would be, for her mere *form* may give her a speed of 6 knots instead of 12, equivalent to giving you one eighth of your money's value, or to raising the consumption of coals from 2 lbs. to 16 lbs. per horse-power; for the same consumption of coals would drive a well formed vessel at double the speed.

Suppose, again, I take this vessel as she is, as invulnerable as she can be made, and add to it a comparatively light but vulnerable bow, and a similar stern, and by this means I get a high speed; but I get something more; I get a vessel that will weather a gale in comfort; in fact, I then have produced a Warrior. Is the vessel useless because I have added these extremities? Say these extremities can be riddled with shot; but what of that? A craft is produced which instead of steaming to the other side of the Atlantic in a month or more, and then being out of coals, can get there in a fortnight or less, and have half her coals left to get to business with; and these extremities can be so divided by longitudinal partitions that it will be practically very improbable that her bow or stern will ever be deflected many inches by the entrance of water. Every engineer will admit that a small consumption of coals is a great desideratum; yet many, having attained that end as to indicated horse-power, would think lightly of the fact that a waste of 75 per cent. of power is incurred from the bad form of a vessel. Economy in consumption of coals is intimately connected with economy of resistance to motion.

If we were now at war, and for the defence of Liverpool we had one strong, slow, iron-cased vessel, and the enemy had such a vessel as the Warrior approaching, the latter vessel would be able to approach the land fearlessly; her ends might receive a shot or two, but it would not much matter, she would be able to distance the "plunger," bombard various parts of the coast while the other craft was working up, and then, after doing great mischief, she could either accept battle or repeat the same operations elsewhere, and the coast defence slow-going craft would have but a sorry log to show afterwards.

I have very little faith in "ram" operations; an iron vessel against a wooden one is all very well, but I think iron-cased vessels will be as little likely to try the experiment on each other as the old wooden vessels were.

I am, Sir, your very obedient servant,
T. MOY.

1 Clifford's Inn, May 3rd., 1862.

A PROPOSAL FOR A PARTIALLY IRON-CLAD VESSEL.

SIR,—The problem in Naval Architecture which the *Times* has repeatedly invited scientific men to solve, is to construct a vessel as formidable and as invulnerable as the Monitor, equally moderate in tonnage and expense, and yet with good sea going properties, including therein, of course, along with other qualities, good speed, and a capacity to carry the usual proportion of coals to engine power. Now this is an assemblage of incompatibilities, and it might as well call for a realization of perpetual motion. The only way in which it is possible to make an approximation towards such conditions in a vessel, or which, with the aid of a consort, may serve in a manner as a succedaneum, is to contrive to have as little as possible of the hull above water, that so by a reduction of the surface to be armoured, the weight of iron plates shall not greatly exceed the weight saved by such cutting down. Now a further advance in this direction—but how far possessing a useful practical character I will not dogmatically affirm, but leave it to the judgment of professional men—would be, to submerge, say two thirds of the hull several feet below the surface, leaving one-third amidships to be armoured, of sufficient height and buoyancy to carry guns efficiently, and serve other nautical purposes, ventilation, sailing, promenade, &c. In this way two-thirds also of the weight of armour now placed below water would be dispensed with. The vessel would thus be relieved of weight at the stem and stern, which would greatly conduce, or rather would be indispensable to, its sea-going character. The propeller under the circumstances must be more than usually limited in diameter, I would therefore provide two, one on each side of the rudder.

It would be of the first importance to a craft of this kind, in order to render her formidable, that she should be able to command in cases of emergency great speed and great mobility, to save her, for instance, from being run down by a heavier vessel, to enable her to choose her own distance and position in attack or defence, and to overtake an enemy. As it would be impossible for her to carry much more than a day's consumption of coal, when working in these cases to the utmost extent of the great engine power with which she ought to be provided, she must in time of war be accompanied by a sailing vessel carrying coals only, but provided with a small amount of engine power. As convoy to a fleet, colliers should form a part. The ordinary consumption of coal should not, on an average of sailing days, be more than one-tenth of what she would be capable of turning to account. As to mobility, the two propellers would be great aids, and to assist in hunging the head round the simplest means (seeing that the work to be done would be short and occasional only) would be jets of water on either side of the bow, or rather, the simultaneous action of influx on one side and efflux on the other. It appears to me that now more than ever a vessel wants the power of turning independently of progressive motion.

The portion of the hull which would not be submerged, and which would in appearance be the ship itself, should present an angle both at stem and stern, in order to diminish the resistance of the few feet depth of water which it would have to meet; and thus this form would determine the way in which such a vessel ought to be fought, namely, end on. A casemated gun in each angle, and a cupola in the centre on a higher level and carrying two guns, would be sufficient armament for such a class of vessels; as against a fort, or against a single vessel, a ship so constructed and fought would not require to be heavily armoured, if at all, on her sides, and if beset by enemies she must take to her heels. Such a vessel, even as a harbour defence, would be more efficient than an unwieldy floating battery, like the Monitor, for she could elude being run down, whereas a Warrior, or at any rate a ship of the class above it now building, would send to the bottom a dozen Monitors in succession. The Americans talk of being able with some of their ships to run down even the Merrimac. Nothing will suffice for harbour defence but ships of equal power with those of the attack, or else light craft with great speed and agility, but heavily armed. I have no room nor time now to discuss the topic of resistance opposed by water to such description of vessel.

I am, sir, yours truly

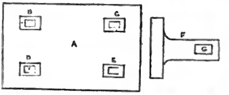
Benjamin Cheverton.

◆

IRON-PLATED SHIPS.

Bolton, April 17th, 1862.

Sir,—I do not profess to know anything about iron ships, but from reading "a Civilian's" letter in your paper it appears to me that if iron plates could be secured to ships' sides without drilling or cutting the iron in any way, but placed there like a piece of paper cemented to a flat surface, it would avoid the weakening caused to the plates by such methods of fastening. Do you think the following plan practicable, and if so, would it sufficiently secure the plates, and at the same time render the mischief of drilling, tongueing, and grooving, &c., unnecessary? Let *A* represent an iron plate of any size and thickness that be best, and let *B C D E* be four pieces of iron of this shape (taking the other view enlarged) welded to it. Now, by letting projecting arm *F* pass through the backing of the ship, and driving a slightly beviled key through the hole *G* in it, it would draw the plate and backing firmly together, and if the surface rivetted to the plate were large enough I think it would not soon leave it. I also think such a plan would rather tend to strengthen the plate than otherwise.



Of course I do not expect such a method would entirely answer, but as the idea struck me, and not having seen it before, I thought it would not be useless to communicate it.

Yours most respectfully,

J. A. Slater.

◆

THE AQUEOUS THEORY.—A CURIOUS FACT.

Sir,—I send you a small communication, begging the insertion of it in your useful Magazine. *Apparent rari nantes in gurgite vasto;* Pliny says—"*Anguilla* (the eel) is a fish coming without generation, and only engendered in the slime of the earth." Now, it is a curious fact that in this month *(May)*, if you take two pieces, or sods, of turf about two feet square on a dewy night, and let them lie on one another, with the grass inwards, for a considerable time, you will find some small eels, of silvery whiteness, *generated by the dew,* about one foot in length. In flavour they far surpass the river or pond eel.

I am, Sir, yours, &c.,

James Bruce.

London, May 6th, 1862.

P.S.—In India it is no uncommon occurrence for the natives to gather large quantities of edible fish, "*after the rains,*" from ponds that were long dried up.

◆

ATLANTIC TELEGRAPHY.

Sir,—I beg leave to send you some of my reasons for believing that the old Atlantic cable broke down because they tried to work through so long a circuit too fast, employing too great a battery power for the purpose.

The line worked well, considering its length, after it was laid so long as its powers were not overtaxed, and to prove the correctness of this statement we will take the company's own record of its condition at the time. The laying of this line was completed on the 5th August, 1858. On the 10th a report from Mr. Whitehouse was communicated by the secretary to the daily papers, stating that "the rate of transmission fully equals that obtained at Keyham," that is to say, the working of the line was as good as it was when lying in the tanks at Keyham before the ships sailed. On the 17th August Mr. Saward wrote to the *Times* and other papers.

"I have the pleasure to inform you that the line from Valentia is now working satisfactorily both ways," and after giving two long messages that passed through, he said, "it will thus be seen that the line is now capable of being worked with perfect accuracy, and the company will now proceed as rapidly as is consistent with the establishment of a proper system to make the necessary arrangements for opening the communication to the public."

On the 20th Mr. Saward wrote again giving a long message received from Newfoundland, with details of the collision between the Arabia and Europa, and said "the message, asking Newfoundland for further particulars, was despatched from London 3 p.m. last evening, and the above reply was received back at 7.30 p.m." To get to Valentia, the message at that time had to be transmitted at several intermediate places, so that the line must have been working well across the Atlantic.

On the 23rd he published copies of the message from the Queen to the President, and the reply thereto, consisting of 143 words, which, with several "repeats" and corrections, he stated, took two hours to pass through the cable between Newfoundland and Valentia. The cable was, therefore, then capable of being operated at a commercial rate of about 1¼ words per minute, this was as great a rate as could be worked before being put on board of the ship, but it was very far short of the ten words per minute promised by Professor Morse, and officially published by the board of directors of the company, in their pamphlet, entitled "The Atlantic Telegraph," a descriptive history, July, 1857, when the manufacture of the cable was completed. At this later date, however, the two halves of the cable, the one made at Birkenhead, and the other at Greenwich, had never been put together, and the actual working results, when joined together in one circuit, as given above, is a striking example of the impolicy of attempting to work too long circuits.

On the 25th August the company reported, under date "Valentia, 25, 1 a.m., the cable is now working splendidly. We are *conversing freely* with Newfoundland. The signals to and from are *strong* and *perfect*. A telegram has just been received, dated New York, August 25th, 12.53 a.m., stating that the Persia has just taken the Europa's passengers and mails." Following this was another long message from Newfoundland, forwarded for publication on the same day, by Mr. Samuel Gurney, M.P., and Professor Thomson, two of the company's directors, then at Valentia. On the 31st, important Government messages were sent to Canada, which saved this country, as the company say, about £50,000.

On the 1st September a message was sent, informing the American Government that a company were ready to forward their Government messages; the latter part of this message never reached the other side, the cable broke down in sending it, as I, and many other practical telegraphists, believe, in consequence of having used too great an amount of battery power, by which the cable was destroyed, a result that will inevitably follow in the working of any very long circuit.

After the line broke down, a host of advisers were called in, and without any disparagement or disrespect for those gentlemen, we may fairly assume that they *would not* settle the cause of the failure to be the length of the line; or if any of them did in such a report, the company has not published it.

It was, therefore, argued that the cable must have had a defect somewhere, because the register at Keyham shewed that one half did not test so well as the other—a very natural result, considering the time occupied in its manufacture, and the advance made in insulation during the construction of 2,500 miles of line. If any defects existed in the cable before it was laid, they did not, as we have seen, retard the working of the line when it was first operated upon. In the evidence taken by the recent Submarine Telegraph Committee, Mr. Saward himself (Blue Book, p. 175) confessed "that slight defects which existed in the cable before it was laid, but were not reported by Mr. Whitehouse, were increased after the cable was down *by the injudicious use of battery power.*"

Mr. Varley, the company's present electrician, also reported that "it is not at all improbable that the powerful currents from the large induction coils have impaired the insulation, and that *had more moderate power been used, the cable would still have been capable of transmitting messages.*"

Putting these facts together, no unprejudiced or competent person can for a moment doubt that the enormous length of the circuit which tempted them to use an improper amount of force, in order to accomplish their theoretical deductions as to speed of working, was the fatal and still incurable cause of all their misfortune, and the only result which can attend any further ill-advised attempts in the same direction, will be the utter loss of the capital invested, and the postponement of a telegraph to America for many years to come.

I have the greatest personal esteem for the worthy secretary of the Atlantic Telegraph Company, and ascribe all credit to him for making the best of what seems to me to be a very bad case, but it is evident that he is not ignorant of the objection to working a very long circuit (provided that it be but a little longer than his own), for when he was asked by the committee as to the direct route from Falmouth to Halifax, over which Messrs. Glass, Elliot, and Co. recently proposed to lay a cable for the Government, which would require about 2,300 miles of cable, instead of the 2,100 needed for his line, he rather vaguely estimates the amount of cable required for that route at from 3,000 to 4,000 miles, and leaves it for the electricians to deal with; for as he says, "I fancy if their law of the squares is to hold good, they will consider a line of a little more than 2,000 miles a good deal preferable. *O cæcæ mentes hominum!* What does Mr. Saward say to a line with sections of 700 miles, such as on the northern route?

When Mr. Edwin Clark, one of the committee, after that asked him if there was not another route across Russia, which would limit the sea journey to 30 miles over Behring Strait, he answered very frankly, "I have not taken that into consideration," or, in other words, Mr. Saward is not disposed to consider any other route but his own.

Short Circuit.

Gossip.

Certainly one of the most remarkable events in the annals of British coinage was the issuing of Provincial tokens, towards the close of the last century. No less than five hundred varieties of copper coins emanated at that period from Birmingham and other manufacturing towns. The devices ornamenting them were in many instances beautiful specimens of engraving, and well adapted for their purpose. There may be said to have been five distinct classes of tokens, so far as their artistic designs were concerned. There were, 1st, those which were illustrative of public buildings, as for example, Canterbury Cathedral, Yorkminster, Ipswich Cross, Bigod's castle, &c. 2nd, those which commemorated great undertakings in progress, such as the iron-bridge over the Severn, the inclined plane at Ketley, &c. 3rd, those which were emblematical of the industry and commerce prevailing in Great Britain, and which represented ships in full sail, ploughs, looms, and other appropriate insignia. 4th. Those which transmitted "to distant times and ages" the features of remarkable men, as Newton, Shakespeare, Johnson, Howard, and others. Perhaps these portraits were not always strictly accurate; but the same may be said of the effigies of Roman Emperors on Roman coins. The 5th class consists of those tokens which are merely curious. The engraver James was very successful in two landscapes upon the opposite sides of the Dudley token, and his elephant upon the Pidiask exhibition pieces was at least as well represented as the same animal is by old Roman artists upon *denaru* of the family *Cecilia*, or upon those of Julius and Augustus Cæsar. In fact, the tokens drew out much of the artistic talent of the country, and will exhibit to future times the structures and images which they bear long after the originals have mouldered into dust. They justify completely, indeed, the lines of Pope:—

> "Ambition sigh'd—she found it vain to trust
> The faithless column and the crumbling bust;
> Huge moles, whose shadows stretch'd from shore to shore,
> Their ruins perish'd, and their place no more;
> Convinc'd, she now contracts her vast design,
> And all her triumphs shrink into a *coin*."

The miners of Northumberland and Durham have resolved to petition the Legislature to take such proceedings as shall render the workers in the Northern mines less liable to casualties. They ask, first, that it shall be compulsory on coal-owners to sink two shafts to each mine: secondly, that the number of inspectors shall be increased; and, thirdly, that measures shall be taken to secure the better ventilation of mines. The New Hartley Mine is to be reopened. A new company will sink a new shaft, and commence to re-work the coal in the pit.

For the purpose of establishing a telegraph line between Rangoon and Singapore, in order to connect and materially shorten the present system of telegraph communication with India, China, and Australia, a company has been formed, and wish to obtain a subsidy from Government. A letter from Mr. F. Gisborne, relative to this subject, was read at the meeting of the Liverpool Chamber of Commerce yesterday, and the council decided to memorialize Government in favour of the scheme.

Telegraphic Communication with China.—The London and China Telegraph, in giving an account of arrangements making by M. Reuter to obtain telegraphic messages from Omsklahena, couriers are to be dispatched twice a week to Peking, states that Dr. Macgowan had, in his work on the Electric Telegraph, published in the Chinese language, made known a mode which he had devised for adapting the symbols of that language to telegraphic purposes. By Dr. Macgowan's contrivance the many thousand characters of the Chinese language can be communicated by electric telegraph in a fewer number of strokes than are required for our alphabet. Consequently, there are no limits to the extension of the electric-telegraph.

The Size of our Largest Guns.—"A Practical Gunner" in the *Morning Star* says:—"Desirous of clearing away a little of the haziness which now hangs over the gun department, and causes very erroneous opinions to be formed of the size and power of ordnance, I beg to furnish you with the following statement of our three biggest guns, which will, I think, be found correct:—The largest gun successfully used in England is that which was forged by the Mersey Company, and presented to the nation—a noble gift—in 1856. It weighs 22 tons, and has a bore of 13 inches diameter. In November, 1856, this gun was fired at Shoeburyness with 50 lb. of powder, and a solid ball weighing 280 lb., and gave a mean range of 2,433 yards at 5° elevation; but both the gun and its shot were at that time considered to be too heavy for ordinary use. The next gun of large size tried in England was the Prince Alfred, which was also forged by the Mersey Company, and on being fired last year broke up the plates now shewn beside it at the International Exhibition. This piece weighs 10 tons, has a bore of 10 inches, and fired solid balls of 132 lb. at Liverpool, with powder charges of 20 lb., and I think of 30 lb. also. After this Sir W. Armstrong manufactured (partly of coils) the gun which, as was fully anticipated, smashed the Warrior target. This gun weighs 12 tons, has a bore of 10½ inches, and fires a ball of 150 lb. weight; it has just been 'proved' by the customary heavy charges, viz., about double the weight of powder usually fired on service. Of the above ordnance only the Prince Alfred has been rifled; but it does not seem to have been fired since. The other two guns are smooth-bores, and will probably remain so; they are, therefore, a 280-pounder and a 150-pounder respectively, differing only from the old guns in being of wrought instead of cast iron. I have only to add that the Elswick smooth bore 150-pounder (we have no gun so large as a 300-pounder) gave a mean range of about 2,400 yards at 5° elevation, and 3,400 yards at 10°, when fired with 40 lb. of powder.—I have the honour to be, sir, your obedient servant."

THE ROYAL SOCIETY.—The President of the Royal Society, General Sabine, R.A., held his first *conversazione* for the season at Burlington House, on Saturday evening last. For more than two hours there was a constant arrival of visitors, including members of the diplomatic corps and distinguished foreigners from different parts of the world. Notwithstanding the claims of the International Exhibition, the handsome suite of rooms was well furnished with interesting objects, illustrative of botany, ethnology, the fine arts, and physical science generally. The specimens lent from the Royal Gardens and Museum at Kew enabled visitors to inspect that newly-discovered plant *welwitschia mirabilis*, from Western Africa, in all its remarkable ugliness; the cinchona, and other plants, whose utillity and appearance are alike noteworthy. Among ethnological collections were the skulls and flint implements and antlers recently dug up in the excavation for the great outfall sewer near Barking creek; but the most interesting was the series of relics from one of the lake villages of Switzerland. In the time known to geologists as the "stone period" there were numerous villages on the margin of the Swiss lakes built on piles over the water, as is still the practice in the present day in some islands of the Indian archipelago; and within the past four or five years antiquaries and ethnologists have fished up from the mud, where they have been buried for ages, specimens of the pots and pans, the utensils, weapons, and food of the ancient lake villagers. The specimens in question were found at Wangen, on the Lake of Constance; they compromise implements of bone and stone, fragments of pottery, charred wheat and apples, and seeds, and portions of wood, which testify to the destruction of the village by fire; all from the collection of Mr. Henry Christy. Messrs. Siemens exhibited their submarine cables, electric resistance thermometer, and a regenerative gas furnace; and Mr. Wheatstone his latest improved telegraph instruments, sending signals from one end of the building to the other. Messrs. Osler showed a pair of cut glass vases of rare beauty, and two specimens of lapidary cutting with 800 facets; which were but little less brilliant than diamonds. Specimens of smashed targets, shot, and bolts from Shoeburyness, of manufactured iron; Fairbairn's model locomotive tank-engine, and Sir W. Armstrong's model 70-pounder, lent by the War-office, and a section of the iron-plated ship Defence, lent by the Admiralty, attracted much attention. In the course of the evening Professor Tyndall, of the Royal Institution, exhibited a few experiments on electric spectra in the Great Hall, illustrative of some of the most striking phenomena of spectrum analysis, which by the brilliance of their effects elicited general admiration.

AUDACIOUS SOPHISTRY.—"There a is forensic trick well-known in the Old Bailey, and which only the ready wit of a Sam Weller can defeat, by which a witness may be compelled to give an answer to the very reverse of his meaning and of the truth. It consists in imperatively demanding a reply, yes or no, to a question so framed that either is entirely false without the added explanation, which the skilful barrister refuses to let the jury hear. By just such a triumph of audacious sophistry, Lord Palmerston is now seeking to win his cause of Forts against Ships. He puts to the naval officers who urge that steam can still make good its way past stone, the apparently simple and conclusive question whether, if they were attacking Portsmouth, they would prefer to find forts at Spithead or not. Of course the first word of the reply is that they would not; and on this the jubilant Premier appeals to the country to say that he has proved his case. It is, however, our duty to protect the astonished witnesses, as well as the deceived public, from being misled by such an ingenious form of putting the question. We must venture to remind them, that by such evidence Lord Palmerston establishes no higher value for the forts than attaches to the sand banks on which they stand. No Officer, however brave and reckless, can prefer to find obstacles, whether they are natural or artificial, in the way of his attack. Lord Dundonald himself would have greatly preferred that the Basque Roads had not been defended by the boom over which he so gallantly drove his fire-ships. But the true question is, not what an attacking force would prefer, but what it can overcome. And the answer which, if they were permitted, our officers would give to Lord Palmerston's query is:—We should find in the forts an additional obstacle, a source of annoyance, of loss of men, perhaps even of a ship, which we should not hold sufficient to bar an entrance and make Spithead impregnable. And then the real question for the country to consider is, whether, since it must thus in any case maintain a fleet for the defence of the roadstead and harbour, the enormous sums which the fort, will cost, are a better disposition of the money, than if it were spent in providing and maintaining such a fleet."—*Daily News, April 18th*, 1862.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c. 2598, 2611, 2625.
BOILERS AND THEIR FURNACES, &c., 2614, 2646.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2606, 2616, 2632.
SHIPS AND BOATS, including their fittings, 2626, 2633, 2644.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2594, 2617, 2630, 2641, 2647.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2629.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2602, 2604, 2612, 2622, 2624, 2628, 2634, 2645.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
LIGHTING, HEATING, AND VENTILATING, 2615, 2618, 2620.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2592, 2595, 2596, 2610, 2621, 2627, 2639, 2640, 2642.
METALS, including apparatus for their manufacture, 2605, 2609, 2631, 2637, 2643.
CHEMISTRY AND PHOTOGRAPHY, 2597, 2607.
ELECTRICAL APPARATUS. *None.*
WARFARE, 2593, 2600, 2601, 2603, 2619.
LETTER-PRESS PRINTING, &c. *None.*
MISCELLANEOUS, 2608, 2613, 2623, 2635, 2636, 2638, 2648.

2592. H. J. DISTIN. *Improvements in metal musical wind instruments.* Dated Oct. 18, 1861.

This consists in placing a knuckle or loop on the tube of of the ordinary bugle, distant about two or three inches from the mouth piece aperture, and opposite thereto, or nearly so, there is an additional length of tube extending round the coil of the tube of the bugle until it reaches the tube about an inch below the knuckle, and there is a cylinder attached to the ordinary mouth piece with wind passages therein, so constructed, that, when it is intended to produce the sound of a bugle, the wind passages are open through such cylinder, and the knuckle or loop throughout the bell, and the passage to the additional tube is closed; and when it is intended to produce the sound of a trumpet, such cylinder, by being turned partly round, closes the passage through the knuckle, and leaves the lengthened tube open throughout the bell. *Patent abandoned.*

2593. J. CROSTHWAITE and T. E. ARMAN. *An improved swivel target, and signal apparatus to be used with the same.* Dated Oct. 18, 1861.

This invention consists in constructing the circular par of the target in a separate piece, and mounting it so as to swivel on pivots, that either side may be presented to the front. The invention also consists in a method of protecting the marker who is in the rear of the target. Also in an improved system of signals to be used therewith. *Patent abandoned.*

2594. J. GOUCHER. *Improvements in the beaters and drums used in thrashing machines.* Dated Oct. 18, 1861.

This invention consists, 1, in forming the working side of the uprights between which the grooves are formed in the beaters (for which Letters Patent were granted to the patentee, the 31st July, 1860, No. 1,856), with teeth or notches. 2. In forming the drum ends of cast malleable iron or steel, with facings round the edges to give strength and lightness, and in forming the drum beaters of cast or wrought iron, or steel, with beds and projections, for the beaten plate to fit in. *Patent completed.*

2595. E. PEYTON. *Improvements in the frames of metal bedsteads.* Dated Oct. 18, 1861.

This invention consists in casting or otherwise fixing the dovetail tongues on the side and end frames of metal bedsteads at an angle, and in forming the dovetail grooves into which the tongues are to be inserted at a corresponding angle. *Patent completed.*

2596. J. LAWSON and H. CARTER. *Improvements in metal musical instruments.* Dated Oct. 18, 1861

Here the inventors obtain in one instrument the combination of both the tones and the properties of the bugle and the trumpet, and which is readily converted from a trumpet to a bugle, or *vice versa*; they further adopt a particular combination of metals in producing these combined instruments. *Patent abandoned.*

2597. C. D. ABEL. *Improvements in apparatus for the simultaneous manufacture of white lead and vinegar.* (A communication.) Dated Oct. 18, 1861.

These improvements have reference to the simultaneous manufacture of white lead and vinegar, where a lead corroding room is placed above the room containing the tubs wherein the formation of vinegar is being carried on; the acetic acid escaping from the vinegar tubs, is caused to rise into the lead corroding room, and to assist in the conversion of metallic lead into carbonate of lead. *Patent completed.*

2598. C. H. HOLT. *Improvements in steam engines and boilers, and in apparatus connected therewith, part of which improvements is also applicable in the construction of windmills.* Dated Oct. 18, 1861.

This relates, 1. To employing two vertical cylinders, one over the other, to work the same crank shaft, such crank shaft, being placed between the two cylinders, and the steam, after being used at a high pressure in the one cylinder, being used at a low pressure in the other. 2. To forming the cylinder piston with the inside of the top and bottom plates forming the groove for the packing inclined, and the corresponding parts of the packing rings also inclined and divided in width into two parts, so that springs applied between these parts may have a tendency to force them down the inclined surfaces against the cylinder in which such piston works, and thereby obtain a close packing. 3. To applying packing to rotatory pumps or meters formed by the rotation together of two toothed or corrugated surfaces in a chamber, such packing being forced down inclined planes against the revolving wheels by springs or other elastic medium. 4. To applying vertical fire chambers to steam engine boilers, such chambers being fed with fuel at the top, and having the front and back thereof formed of water tubes, the front tube by preference being inclined and "louvre" formed. 5. To regulating the pressure of steam from a steam boiler by applying to the steam passage a pair of valves (one above, the other below) connected together, and to a corrugated undulatory dome of thin metal, adapted to yield somewhat to the passage of steam, and thereby admit of the action thereon of a weighted lever on the outside thereof, the weight on which lever may be varied to suit the pressure required. *Patent completed.*

This consists in simplifying the construction of wind engines and windmills, whereby they are rendered applicable for sawing wood and stone, grinding clay, thrashing and cutting of chaff, and also for grinding corn. *Patent completed.*

2599. W. STREATHER. *Improvements in the construction of wind engines, and in the structure containing the same, parts of which are applicable in the construction of windmills.* Dated Oct. 18, 1861.

2600. W. SADLER. *Improvements in armour-plated ships.* Dated Oct. 18, 1861.

This refers to ships having inclined sides for the purpose of glancing off shot, and consists in making the angle bend above the water line, both at the bow of the ship and elsewhere, and also in making this bend further above the water line at the bow than the distance it is above the water line at the midship section. *Patent abandoned.*

2601. P. ROBERTSON. *Improvements in the manufacture of cartridges.* (A communication.) Dated Oct. 18, 1861.

This consists in the combined processes of making the cases of cartridges of gun cottonised paper or fabric, and waterproofing the same by collodion. *Patent completed.*

2602. B. TAYLOR. *An improvement or improvements in the manufacture of certain descriptions of brace webs.* Dated Oct. 18, 1861.

Here the inventor proposes to employ woollen or worsted webbing with india-rubber, thereby obtaining more brilliant dyes in wool than in cotton. *Patent abandoned.*

2603. T. W. COWAN. *Improvements in the construction of breech-loading ordnance.* Dated Oct. 18, 1861.

The barrel of this gun is mounted upon the usual carriage, and is made without a breech chamber. The breech-piece is formed separately, and is mounted upon an axis or trunnion at right angles to the direction of the bore of the gun; it is arranged so as to turn or rotate upon this axis. This piece has two, three, or more recesses or chambers formed symmetrically in it, the mouths opening up from the axis outwards; these form chambers for inserting the charge, and each in its turn coming into the line in the barrel, and fitting closely to it either by means of a bridle, or by wedges, or such like arrangement; thus, while one chamber is being fixed, the chamber behind, or, rather, since they radiate, the succeeding chamber is being loaded, and the one before that is being cleaned; as the one discharges, another comes into position already charged, and ready for discharging, while the successor is being loaded, and so on; the vent holes may be formed into each chamber in the ordinary manner. *Patent abandoned.*

2604. J. H. Johnson. *Improvements in braiding machines.* (A communication.) Dated Oct. 18, 1861.

This invention comprises, among other improvements, the substitution of helical springs for the weights hitherto employed for giving the requisite degree of tension to the several threads; also certain arrangements for stopping the machine on the breaking of a thread. We cannot here quote the details of the invention. *Patent completed.*

2905. H. Macmeikan. *Improvements in smelting copper, gold, and other ores.* (A communication.) Dated Oct. 18, 1861.

The patentee claims the reduction of ores by fusion of the metallic portions within the substance of the gangue or stony portion of the ores, and without the fusion of the gangue or stony portions themselves, together with the subsequent operation of the metallic and stony portions by crushing and washing. *Patent completed.*

2606. C. Cheyne and T. B. Moseley. *Improvements in the construction of apparatus for signalling on railways, by which improvements the signalling apparatus is rendered self-registering or recording, and also applicable for measuring and recording the speed of passing trains, and the time of their passage, part of which improvement is applicable for recording the speed of trains where signalling is not required.* Dated Oct. 18, 1861.

This invention will be noticed in a future number. *Patent completed.*

2607. J. Wanetka. *Improvements in manufacturing oxygen, and obtaining certain other products.* Dated Oct. 19, 1861.

This invention consists of a mode of treating a mixture of nitrate of soda, or other nitrate, with an oxide of iron or burnt oxide of zinc, for the purpose of obtaining oxygen gas, nitrogenous compounds, and the base of the salt employed. For this purpose the patentee submits the mixture to distillation in a retort. He condenses the nitrogenous compounds contained in the gaseous products of the distillation in water, or in any other convenient manner, and thus separates those compounds from the residue of the gaseous products consisting chiefly of oxygen gas, which he collects in a proper receiver. The residuum in the retort at the end of the process contains the base of the salt employed, which, if it be an alkali or alkaline earth, will be in a caustic state. *Patent completed.*

2608. W. G. C. Hudson. *Copying letters and other written papers or documents.* Dated Oct. 19, 1861.

This invention is carried into effect in the following manner:—In a box or case made of wood or other material, or partly made of wood and partly of another material, and either through the centre thereof, or some part of it, the inventor inserts a roller made of wood or metal, as preferred, having attached to one end thereof a wheel having teeth or cogs therein, near to which is a movable check or repellant power to prevent the roller receding after being wound up, such winding being performed by a spanner or key. To the said roller is connected a piece of cloth which passes through the front of the said box or case whereon the letters or papers are laid for the purpose of being copied, and by the leverage obtained by pressing the said spanner or key, the operation of copying is effected. *Patent abandoned.*

2609. R. Mushet. *A new or improved manufacture of titanic pig metal or alloy of titanium and iron.* Dated Oct. 19, 1861.

The principal feature of this invention consists in smelting that particular variety of titanium ore called ilmenite, and which is a titanite of iron, in conjunction with the red hematite iron ores of Cumberland and Lancashire, or precisely similar red hematite iron ores found in adjacent districts, in a blast furnace heated with coal, coke, or charcoal fuel, in order thereby to reduce the metals contained in the said ore of titanium called ilmenite, and the said red hematite iron ores to the metallic state, and to produce thereby an improved titanic pig metal consisting essentially of titanium and iron, and containing also carbon. *Patent completed.*

2610. T. Lepeinteur. *Improvements in fastenings for gloves, belts, and other articles.* Dated Oct. 19, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2511. T. Fearnley. *Improvements in steam hammers.* Dated Oct. 19, 1861.

The patentee forms the steam cylinder annular, in order that the ram may pass through the inner or central part of such cylinder, and thereby have increased guiding surface in its motion, as also to reduce the height of it, and he forms the piston annular, with rods passing through the head of the cylinder to a cross head affixed to or formed upon the ram, or through the bottom of the cylinder direct to the hammer above the head. He also forms the hammer to surround the cylinder, the piston rod being keyed into the hammer just above the head. In this case the cylinder is fixed to the upper part of the framing, and the framing below is bored to receive and guide the hammer in its motion, whilst the inside of the hammer is bored true to slide on the cylinder. He also gives motion to the valves of steam hammers by means of a spiral groove or feather, cut or formed in the hammer, acting upon a pin or stud in connection with the valve or valves. *Patent completed.*

2612. J. Cooper. *Improvements in carding engines for the carding of cotton, silk, wool, and other fibrous substances.* Dated Oct. 19, 1861.

This invention consists in enclosing the under surface of the "licker in," and of the main carding cylinder, with a curved, double concave screen, such screen being so placed as to be just clear of the card teeth. This screen may be arranged in the form of a venetian shutter, or otherwise, its object and effect being to allow the dust and dirt to pass through, and to arrest the fibres or filaments, which, as they accumulate, will be again taken up by the card teeth, and worked in with the other materials. *Patent abandoned.*

2613. J. Marshall. *The collection, concentration, and transmission of sound, so as to facilitate the hearing thereof.* Dated Oct. 19, 1861.

The patentee claims the construction of apparatuses for the collection, concentration, and transmission of sound, in which a combination of reflecting surfaces is employed, which are so formed, and are adjusted in such relative positions, that the rays of sound are received on one or more of these reflecting surfaces, and are thence reflected in a concentrated manner on to one or more other reflecting surfaces, by which they are again reflected in a parallel or nearly parallel manner into a conducting tube, or into several conducting tubes, which conveys or convey them to the ear. *Patent completed.*

2614. J. Bourne and E. Kidd. *Improved machinery for the manufacture of tubes and cylinders, which is also applicable to other useful purposes.* Dated Oct. 19, 1861.

To accomplish the object of the invention the patentees construct improved machinery in the following manner:—Any given number of rolls or cylinders having slightly concaved peripheries and bevelled edges are mounted in a suitable frame-work; the said rolls or cylinders, when definitely fixed in a working position, are relatively angular, the effect of which may be stated thus: when the metal or alloys of metal designed for a tube or cylinder is fed in upon an ordinary mandril between the rolls or cylinders for the purpose of rolling to a required length, diameter, and thickness, the combined action of the rolls or cylinders, whose motion is rotary, simultaneously imparts a spiral motion to the metal or alloys of metal then undergoing the rolling process, so that independent of their agency the metal or alloys of metal is passed through with great speed, and is then introduced and rolled in like manner again until the same is in a condition to be "finished" at the draw bench by the usual method. *Patent completed.*

2615. J. Wainwright. *Improvements in ventilating rooms and buildings.* Dated Oct. 19, 1861.

This invention is for improvements upon one patented by the present inventor the 20th Oct., 1858, No. 2,345, and consists, 1, in perforating the lower bar of the lower sash of window frames, and in fitting over the same, inside the window, a slide made with perforations and solid parts, in such manner that the perforations in, and solid parts of, the slide may be brought entirely or partially over the apertures in the sash bar. Again, in some cases he receives the air in a case or trough, through apertures in the lower sash bar, and carries tubes up the side frames which communicate with the air case; and he provides outlets in the tubes at various levels. *Patent abandoned.*

2616. C. De Bergue. *Improvements in sleeper-chairs for the permanent way of railways.* Dated Oct. 19, 1861.

This comprises the casting or forming sleeper-chairs with a dished or curved and hollowed, or flatly tapered base or bottom (to be used with the convex or projecting side downwards), with cross-ribs or webs, or with one or more circular or other ring—like ribs or webs, or with a rib or ribs in addition to such ring-like rib or ribs within the upper or concave side of such bed-plate (base or bottom). Also the casting or forming sleeper chairs as above set forth with parts of the ribs or webs fashioned for forming a seat for the rail, in which the rail may be firmly bedded, and so that the rail and sleeper chair may be secured together by one fastening only. Also the casting or forming sleeper-chairs with ribs or webs, or projections from the convex or lower side of such sleepers, so as to admit of the adaptation and fastening of the tie bar to the under side of the sleeper, and securing it thereto by the same bolt or fastening which secures the rail above. *Patent completed.*

2617. W. C. Cambridge. *An improvement in the construction of harrows.* Dated Oct. 19 1861.

The object here is to reduce the number of parts used in securing the tines in position. This improvement the patentee proposes to use in connection with an invention of his for which he obtained letters patent 25th Oct. 1860, and which consists mainly in forming the tines of cross-heads and fitting these cross-heads into a trough or double flanged iron beam. The present invention may, however, be also applied with advantage to other constructions of harrow than that above referred to. The invention is not described apart from the drawings. *Patent completed.*

2618. F. J. Evans. *An improved mode of, and apparatus for, carburetting gases for the purposes of illumination.* Dated Oct. 19, 1861.

This the patentee proposes to effect by passing the gaseous body intended to be carburetted through a suitable arrangement of heating apparatus, and while in a heated state leading it off to a vessel containing an easily volatilizable hydrocarbon. As the gas passes through this vessel, the hydrocarbon will be vapourized, and combine with the heated gas, whereby the requisite illuminating power will be imparted thereto. The mixed gas may then be led off to a burner to be consumed. *Patent completed.*

2619. H. Bloxam. *Improvements in sights for rifles and ordinance.* Dated Oct. 19, 1861:

This consists in the application to the sights of rifles and cannon of a small vibrating pendulum, mounted on a transverse pin, and attached to a suitably shaped piece of metal, which is attached to the sliding bar of the rifle or cannon sight by two small gripping springs which hold the vibrating pendulum and piece of metal to which it is attached in position, and the piece of metal to which the vibrating pendulum is attached is so constructed as not to interfere with the line of sight. The vibrating sight pendulum may be readily fixed to or removed from the rifle or cannon sight, and when in position is pressed down level with the top of the sliding bar, and two small projections at the back of the metal to which the springs are attached are so formed as to just embrace the flap end and prevent any lateral movement. *Patent completed.*

2620. H. Lamplough. *Improvements in the means of igniting the wicks of candles and lamp wicks.* Dated Oct. 21, 1861.

This invention consists in applying to the ends of the wicks of wax, tallow, or other candles, and also to the ends of the cotton wicks used in lamps at which they are intend to be lighted, any of the known compositions which are used on wax taper lights or matches for ignition by friction or percussion, so that candles or lamp wicks having such composition thereon may be readily ignited by friction, pressure, or percussion properly applied to the composition in the usual way. *Patent completed.*

2621. C. Mc Dougall. *Improvements in connecting and fastening the bands of covered steel or other materials used in crinolines.* Dated Oct. 21, 1861.

This consists in passing the ends of the band of covered steel or other material used for crinolines into a double clip, having at each end a number of curved or angular elastic teeth on one or both sides bending inwards, in such manner that the ends of the material can be entered but not withdrawn except intentionally. *Patent completed.*

2622. J. Smith. *Improvements in machinery or apparatus for combing cotton or other fibrous substances.* Dated Oct. 21, 1861.

This refers to a previous patent dated 7th February, 1860 (No. 346), and consists, 1. In forming the framing or comb bed in inclines, by which the combs are successively lowered into position to receive the feed or supply of cotton or other fibre, and raised again for operating upon it. 2. In the use of a series of knives or plates arranged and operated so as to press the fibre into the teeth of the combs. 3. In the application of a cam or finger for giving a quick impulse to the combs at the change of direction from the same lines, so as to remove each quickly out of the way of the succeeding comb. 4. In the application of cogs or teeth on the under side of the combs and cog wheels gearing therein, for impelling them forward on the line of transit to the other screws. 5. In a method of making or constructing the screws for propelling the combs by wrapping or coiling a rod to form the thread around a spindle, and securing it therein with pins driven through into the spindle, or by screws inserted therein, or other fastenings. 6. In supporting the drawing off rollers on a pillar, and passing the driving spindle through the same. 7. In taking the cleansed cotton or other fibre from the drawing leather by a card roller and doffer plate. 8. In extracting the wool from the combs by placing the rollers over the points of the teeth. *Patent abandoned.*

2023. J. T. Smith. *An improvement or improvements in collecting the inflammable gases evolved from blast furnaces.* Dated Oct. 21, 1861.

The patentee claims covering the top of blast furnaces with a dome or arched cover, through openings in which dome or cover the materials are charged into the said furnaces, the said dome or cover always preserving a clear space above the said materials, from which space the inflammable gases are collected by means of a pipe or pipes. *Patent completed.*

2624. E. Oldfield. *Improvements in self-acting mules for spinning and doubling.* Dated Oct. 21, 1861.

This invention consists, 1. In an improved combination of parts for effecting the first and second changes in the position of the long lever, which is connected to the cam shaft as in the mules known as Roberts's self-actors. 2. In an improved arrangement of parts for tightening the backing off chain. 3. In an improved combination of parts for preventing the rise of the faller until the spindles are turned round to coil the yarn up, the spindles thereby preventing snarls. *Patent completed.*

2625. F. A. Calvert. *A new engine to be propelled by compressed atmospheric air or steam.* Dated Oct. 21, 1861.

This consists in supplying compressed air or steam from a reservoir or boiler to one or two cylinders, each cylinder containing two pistons, each lower piston containing one or more vacuum valves for supplying the upper pistons with the air or steam when the expansive force of the compressed air or steam is expended. *Patent completed.*

2626. J. S. Phillips. *A new method and apparatus for the propulsion of vessels through water.* Dated Oct. 21, 1861.

This propeller or paddle is formed of the shape of the hoof of a calf or other animal; or of the shape of the webbed foot of the diver or other swimming bird. The paddle is to be applied to a wheel or wheels on the side of a vessel, or underneath entirely or in part. The upper or back part of the propeller is to act as a screw propeller, and the under or open sole of the hoof as a paddle. The said hoof screw paddle is to be applied to the radius of a wheel, or on long bands, as in a dredging machine. *Patent abandoned.*

2627. W. E. Gedge. *Improvements in the manufacture of flannel.* (A communication.) Dated Oct. 21, 1861.

In the manufacture of twilled flannels it is proposed, by this invention, to take threads of combed wool, warping, dressing, and weaving by the usual means, using a woof of combed wool of a number regulated by the quality of flannel to be made. In manufacturing another description of flannel, known as "Rolands," it is proposed to take threads of combed wool of a thickness suited to the thickness to be given to the fabric, warping, dressing, and weaving by the usual means, using a woof of combed wool, and burling and picking if necessary, but if the knots are neither strong nor numerous, it will suffice to raise or nap the stuff after welting. *Patent abandoned.*

2628. F. Fenton. *Improvements in obtaining and treating fibrous substances.* Dated Oct. 21, 1861.

This consists in treating all that class of plants known to botanists as the endogene, and the leaf-stalks, leaves, and the bark of all the Exogenous tribe of vegetation, by dilute solutions of acids, alkalies, and ammonia, thus producing fibrous material of great commercial value. *Patent completed.*

2629. W. Winniatt. *Improvements in machines for kneading dough.* Dated Oct. 21, 1861.

Here the inventor substitutes one blade forming severa-

Digitized by Google

elements of a helical plane. This blade is held in its position, by attaching each end of the screw so formed directly to a pivot which revolves in suitable bearings. The screw revolves in a trough of wrought iron galvanized, or of other material. The screw or helical knife is set in motion either by the application of direct power, or by the intervention of rack and pinions, or other contrivance. *Patent abandoned.*

2630. N. D. P. Maillard. *Improvements in ploughs.* Dated Oct. 24, 1861.

This relates to that part of the plough which turns over the earth after it has been cut away from the land. By this invention a considerable portion of the ordinary turn furrow breast of the plough is dispensed with, and in place thereof a series of vertical rollers or cylinders are employed to turn over the earth. The object of the invention is to reduce the friction of the earth against the several parts of the plough as much as possible, and therefore the inventor not only uses rollers or cylinders as a means of turning over the earth instead of the ordinary breast, but he also introduces horizontal rollers in the sole plate, and another set of vertical rollers at the back of the plough for the purpose of maintaining the plough in a vertical position. The vertical breast rollers are mounted in a frame which turns on a centre pin near the fore part of the plough, so that, by pushing the vertical roller frame outwards, and setting it at any given position, the furrow may be wider or narrower as it may be required or considered desirable. *Patent abandoned.*

2631. J. Toward. *Improvements in machinery or apparatus for bending iron.* Dated Oct. 21, 1861.

This consists in the use of three rolls (suitably grooved) driven by any ordinary gearing, and so arranged as to impart any desired curve to the iron which is passed between them. These rolls are placed on three shafts, and made to overhang the bearings, each roll being pushed on its shaft endwise, and kept in position by a collar, and driven by a key. Two of the three rolls are made in two halves, so that one half may be removed, and thus admit of the easy disengagement of the hoop when formed. By changing the position of the rolls from one shaft to the other, the feathers upon the angle or T iron may be bent either externally or internally. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Feb. 11, 1862.

360. G. Lindemann, Manchester, engineer. Improvements in applying gas for the purpose of singeing or dressing yarns or threads and woven fabrics, and for obtaining heat for other purposes.

Dated Feb. 20, 1862.

451. E. M. Stoehr, Manchester, merchant. Improvements in the manufacture of manganese, and in the combinations of manganese with other metals. (A communication.)

Dated March 14, 1862.

710. W. Turner, 39 Hockley, Nottingham, baker. Improvements in the construction of bakers' ovens, and in the use of furnaces and other apparatus connected therewith, and in the means or appliances employed therein.

Dated March 15, 1862.

714. C. N. Kottola, Bell Isle, Middlesex, soap manufacturer. Improvements in the manufacture of combined soaps.

Dated March 17, 1862.

729. W. E. Gedge, 11 Wellington-street, Strand. Improvements in the manufacture of crinolines. (A communication.)

Dated March 31, 1862.

901. J. M. Clements, Birmingham, tailor. Certain improvements in sewing machines for performing the various kinds of work necessary in stitching, button, and eyelet-hole working, embroidering, and sewing generally.

Dated April 1, 1862.

911. W. Turner, 39 Hockley, Nottingham, baker. Improvements in machinery or apparatus employed in the manufacture of dough, and especially of fermented dough.

Dated April 3, 1862.

938. W. Helme, Caldbeck, Cumberland. Improvements in firelighters.

939. R. Morton, engineer, Stockton-on-Tees. Improvements in refrigerators or apparatus for cooling liquids, parts of which improvements are also applicable to distillation, surface condensation, heating air for blast furnaces, and other similar purposes.

Dated April 4, 1862.

956. T. Silver, Philadelphia, U.S. Improvements in governors for regulating the speed of steam and other engines.

Dated April 9, 1862.

1010. J. Bullough, manufacturer, and J. Bullough, machinist, Baxenden, Lancaster. Improvements in looms for weaving.

Dated April 10, 1862.

1021. D. Fryer, Carlton-square, Old Kent-road, Surrey, and W. J. Williams, Arundell-street, Strand, gentleman. Improvements in the method of and apparatus for letting on and cutting off the supply of gas to groups or districts of street and other lamps from a central point or depot.

1038. A. Trimen, 9 Adam-street, Adelphi. The protection and solidification of magnesian limestone and other stones, and for the prevention of the passage of water through the same.

Dated April 12, 1862.

1054. J. Bunnett, Deptford, engineer. Improvements in revolving shutters, and in machinery for producing the same.

Dated April 14, 1862.

1070. J. Dargue, 63 Cobden-street, Lister-hills, Bradford. Improvements in machinery for preparing and combing wool and other fibrous materials.

Dated April 15, 1862.

1079. J. Taylor, Lyon-mill, Oldham, Lancaster, cotton spinner. Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

1080. T. H. Bennet, Winchester-house, Southwark, Surrey, hat manufacturer. Improvements in the manufacture of hats, caps, or other coverings for the head.

1081. F. A. Le Mat, New Orleans, U.S., Colonel Aide-de-camp, and C. F. Girard, Washington, doctor of medicine. Improvements in the construction of revolving and repeating fire-arms, part of which invention is also applicable to other arms.

1082. R. Roche, Southsea, Hants, lieutenant R.N. An improvement in gun carriages.

1083. C. R. Heap, Great George-street, Westminster, agent. An improved construction of railway chair. (A communication.)

1085. G. Bedson, Manchester, manager. Improvements in the manufacture of wire ropes, and in the preparation of wire for such manufacture.

1086. J. Platt, Oldham, Lancaster, and W. Cheetham, Moscow. Improvements in looms for weaving.

1087. J. Platt, Oldham, Lancaster, and W. Richardson, mechanical engineers. Improvements in machinery or apparatus for cleaning wool and other hairs of animals from burrs and other foreign matters.

1088. R. A. Peacock, St. Helier, Jersey, civil engineer. Improvements in constructing and working lock-gates for docks, harbours, canals, and navigable rivers.

1089. W. Clark, 53 Chancery-lane, Middlesex, engineer. Improvements in ornamenting fabrics and other surfaces. (A communication.)

1091. F. C. Philippson, Munzstrasse, Berlin. Improvements in steam hammers. (A communication.)

1092. J. Crossdale, 2 Rotherfield-street, Islington, boot maker. Certain improvements in boots and shoes for ventilating same.

1093. R. Rains, 4 Crescent, Bridge-street, Blackfriars. Improvements in apparatus for freezing, cooling, and churning. (A communication.)

Dated April 16, 1862.

1094. S. Barrett, machinist, 8 Clifton-street, Finsbury. Improvements in projectiles.

1095. F. N. Gisborne, 3 Adelaide-place, London-bridge, engineer. Improvements in the construction of electric targets for rifle and gun practice.

1097. J. Barbour, Liverpool, merchant. Improvements applicable to upholsterers' and other hand hammers. (A communication)

1098. W. F. Lock, Haylands, Ryde, Isle of Wight. An elongated projectile to be shot from smooth bored ordnance, and which shall retain during its flight the longer axis in the direction of its line of flight similarly to elongated projectiles propelled from rifled ordnance.

1099. J. W. Hadwen, Kebroyd Mills, Halifax, York, cotton spinner. Improvements in the treatment and application of soft silk waste.

1100. D. Stott, Firth House Mills, Stainland, York, paper manufacturer. Improvements in the manufacture of rings from paper, millboard, or pasteboard, applicable for steam or other pipe joints, bobbin ends, or other purposes, and in the means or apparatus employed therein, which are also applicable to the manufacture of rings from other flexible substances.

1101. J. Mackay, Liverpool, timber merchant. Certain improvements in projectiles for fire-arms.

1102. J. M. Rowan, Glasgow, engineer. Improvements in manufacturing articles of cast steel.

1103. R. Cochran and R. Cochran, jun., Paisley, Renfrew, manufacturers. Improvements in producing ornamental fabrics.

1104. F. P. Warren, East Court, Cosham, Hants, commander R.N. Improvements in apparatus for steering sea going vessels.

1105. M. Cartwright, St. John's-row, Hoxton, Middlesex, dentist. Improvements in the manufacture of models, and of plates or pieces for artificial teeth, and in combining or amalgamating india rubber and gutta percha with metals for the manufacture of artificial plates or pieces, and for other purposes.

1106. W. J. Marsden, Sheffield. Improvements in eye-shades.

1107. W. E. Newton, 66 Chancery-lane, civil engineer. An improvement in setting artificial teeth. (A communication.)

1108. W. E. Newton, 66 Chancery-lane, civil engineer. Improvements in the manufacture of cannon and other ordnance, and of solid and hollow cylinders for shafting and other purposes of wrought iron or steel, or both combined. (A communication.)

1109. J. Stanton, Birmingham, engine-fitter. Improvements in apparatus or machinery to be used in stamping or piercing metal washers and other similar articles.

1111. S. Ashbury, Manchester, contractor. Improvements in the permanent way of railways.

1112. J. H. Johnson, 47 Lincoln's Inn Fields, gentleman. Improvements in railway and common road carriages. (A communication.)

1113. J. W. Ford, Shooters-hill, Kent. Improvements in sewing machines. (A communication.)

1114. J. Weston, 80 Upper Whitecross-street, St. Lukes', engineer. Improvements in machinery for morticing, drilling, and dove-tailing, and in tools to be used therewith.

Dated April 17, 1862.

1115. C. D. Abel, 20 Southampton-buildings, Chancery-lane. Improvements in the manufacture and production of the chromates and bichromates of potash and of soda. (A communication.)

1117. V. Fleury, 23 Rue de la Paix, Paris. Improvements in clocks and time-keepers.

1118. W. H. Hutchinson, Bury, Lancaster, starch manufacturer. Improvements in the manufacture of ammonia or its salts, and cyanogen or its compounds, from refuse gluten.

1119. J. Griffiths, Liverpool, civil engineer. Improvements in propelling ships and other navigable vessels.

1120. W. Harling, J. M. Todd, and T. Harling, all of Burnley, Lancaster, machine makers. Improvements in looms for weaving.

1121. F. Tolhausen, 17 Faubourg Montmartre, Paris. An improved machine for making bricks, tiles, and the like articles. (A communication.)

1122. J. Murphy, sen., Glasgow, pattern designer. Improvements in looms.

1123. J. P. Temperley, Soho Iron Works, Bolton-le-Moors, Lancaster, engineer. Improvements in the air pumps of steam engines.

1125. J. L. Perin, engineer, 97 Rue du Faubourg, St. Antoine, Paris. Improvements in machinery for mortising wood.

1126. H. Gardener, Leeds, manufacturer. Improvements in machinery for breaking and preparing flax and other fibrous substances.

1127. C. D. Abel, 20 Southampton-buildings, Chancery-lane. Improvements in the manufacture and production of certain alloys containing cadmium. (A communication.)

1128. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in taps and valves. (A communication.)

1129. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in buffing apparatus and in draw springs. (A communication.)

1130. W. Anderson, 85 Shaftesbury-street, Middlesex, engineer. Improvements in tubular steam generators.

1133. W. Clark, 23 Chancery-lane, engineer. Improvements in the manufacture of railway rails. (A communication.)

1134. J. C. Rivett, Prestolee New Mills, Farnworth, Lancaster, cotton spinner, and J. M. Hetherington, Manchester, machine maker. Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

1135. R. Wedgwood, Barnes, Surrey, gentleman. Improved apparatus for facilitating the saving of life in cases of fire.

Dated April 19, 1862.

1136. R. Denison, Lancaster, joiner. Improvements in reaping and mowing machines.

1137. E. Dove, Hunter-street, Middlesex, gentleman. Improvements in matches and fuzees, and apparatus for containing and igniting the same.

1138. J. S. Phillips, Major H.M.'s I.R. List, 10 College-crescent, Finchley-road, Middlesex. A new method and apparatus for the propulsion of vessels through the water.

1139. J. Shanks, Barrhead, Renfrew, plumber. Improvements in apparatus for promoting ventilation, also applicable to drying stoves.

1140. M. Masters, New Kent-road, Surrey, artificial hand and leg manufacturer. Improvements in artificial legs.

1141. R. Stuart and G. Stuart, spindle and flyer manufacturers, and H. Hill, bookkeeper, all of Sheffield. Improvements in fastening flyers upon spindles.

1142. B. Rhodes, Old Ford-road, Bow, Middlesex. Improvements in the machinery for, and in the method of making, as also in the materials to be employed in the manufacture of cylinders, tubes, and other vessels from paper and other materials of fabrics.

1144. B. Browne, 52 King William-street, London, civil engineer. Improvements in breech-loading fire-arms. (A communication.)

1145. E. Loysel, Cannon-street, London, C.E. Improvements in locks and fastenings.

1146. W. Rose, Hales Owen, Worcester, manufacturer. Improvements in the manufacture of tubes, more especially applicable to the barrels of fire-arms and ordnance.

1147. A. Parkes, Liverpool-street, Birmingham. Improvements in the manufacture of rollers for surface printing and embossing.

1148. A. N. Wornum, Store-street, Middlesex. Improvements in pianofortes.

1150. H. Lumley, Chancery-lane, auctioneer. An improved rudder.

Dated April 21, 1862.

1154. J. Pickard, engineer, and T. Morris, broker, Preston. Improvements in furnaces for the prevention or consumption of smoke.

1156. S. F. Griffin, New Adelphi Chambers, Middlesex, civil engineer. Improvements in the construction of vessels of war and batteries on land.

1158. E. F. Clarke, Waterloo, near Liverpool, gentleman. Improvements in propellers for steam ships and other vessels.

1159. R. A. Brooman, 166 Fleet-street, London, patent agent. Improvements in jackets or protectors for covering metal and other surfaces to prevent loss of heat by radiation. (A communication.)

1160. F. Tolhausen, C.E., 17 Faubourg Montmartre, Paris. An improvement in horse shoes. (A communication.)

1161. T. Attwood, Lewes, Sussex, ironmonger. Improvements in kitcheners.

1164. J. C. Amos, Grove, Southwark, Surrey, engineer. An improved mode of and improvements in apparatus for supplying surface condensers with water, part of which improvements is applicable to blowers and rotary pumps generally.

1165. C. C. Creeke, Bournemouth, Hants, architect. Improvement in the construction of drain and other pipes.

Dated April 22, 1862.

1170. C. Webster, Park-steps, Ilkeston-road, Radford, Nottingham, locksmith. Improvements in self-acting fountains adapted for garden engines, fire-engines, and for raising and forcing water from mines, wells, and other places.

1171. A. Warner, Threadneedle-street, London, merchant. Improvements in the construction of vessels of war and in floating or other batteries.

1172. J. H. Johnson, 47 Lincoln's-inn-fields, Middlesex, gentleman. Improvements in apparatus for propelling and manœuvring ships. (A communication.)

1173. G. Scoville, Wood's Hotel, Furnivals-inn, London, attorney-at-law. Improvements in pistons for steam engines. (A communication.)

1174. R. Roby, Bury St. Edmunds, Suffolk, agricultural implement maker. Improvements in the construction of apparatus for rolling or crushing land.

Dated April 23, 1862.

1176. L. Holden, Burnley, Lancaster, saddler. Certain improvements in harness for animals of draught and burden.

1180. W. Carpenter, Greenwich, Kent, printer. An improved method of printing in colours.

1182. A. Robertson, 22 Bachelor's-walk, Dublin, surgical instrument maker, and R. Barter, St. Annes, Blarney, Cork, doctor of medicine. Improvements in apparatus for distributing and projecting fluids either for surgical, sanatory, or domestic purposes.

1186. G. T. Bousfield, Loughborough-park, Brixton, Surrey. Improvements in the construction of elliptic springs for wheel carriages and other purposes. (A communication.)

1188. W. E. Newton, Chancery-lane, civil engineer. An improved fertilizing composition. (A communication.)

1190. C. E. Heinke, 79 Great Portland-street, Middlesex, submarine engineer. Improvements in diving helmets, dresses, and apparatus, parts of which improvements may also be employed for extinguishing fires in ships and other confined places.

Dated April 24, 1861.

1194. J. Bond, Burnley, Lancaster, machine-maker. Certain improvements in projectiles, which improvements are applicable to horns attached to vessels for war purposes.

1196. J. Winsborrow, 4 Samson-terrace, Marlborough-road, Dalston, Middlesex, gas meter maker. Improvements in wet gas meters.

1198. J. A. Traversier, 21 Rue Sainte Appoline, Paris. Some improvements in making ladies' bonnets.

1200. G. W. Belding, 7 King-street, Cheapside, London, gentleman. Improvements in harrows or cultivators. (A communication.)

1202. R. Mushet, Coleford, Gloucester, metallurgist. An improvement or improvements in the lining, repairing, or "fettling" of puddling furnaces.

1204. R. Zimara, St. Petersburg, Russia, engineer. Improvements in stoves for heating and ventilating buildings.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1244. W. T. Glidden, Massachusetts, U.S. A new and useful mode of restoring phosphatic guano. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

327. J. Rosindell. Separating solid from liquid substances.
3228. T. Simmons, and T. Timmins. Vessels.
3229. J. Jones. Manufacture of lead.
3235. B. Needham. Cleansing boilers.
3237. J. N. Palmer. Stoves. (A communication.)
3238. W. Hawksworth. Carding engines.
3243. T. W. Atlee. Cocks or taps.
3247. J. J. H. Faiole and P. A. Agostini. Composition for painting.
3250. A. Warner. Cases.
3258. J. B. Payne. Twine.
3264. N. McHaffie. Ventilators or valves.
3268. J. Haslam. Apparatus for winding, holding, and letting go cords.
6. T. C. Clarke. Heating and circulating water.
8. R. A. Brooman. Shears or scissors. (A communication.)
11. B. Rhodes. Pipes and bends for pipes.
22. G. Jeffries. Fire-arms.
27. W. E. Gedge. Dressing, cleaning, or sifting grain. (A communication.)
64. H. Chatvet. Spinning cotton.
68. B. Thompson. Ordnance. (A communication.)
77. W. H. Preece. Signalling.
82. H. Charlton. Shoes.
163. L. Martin. Treatment of mineral oils.
166. E. Page. Laths for Venetian blinds.
710. W. Turner. Ovens.
735. B. Todd. Manufacture of antimony.
736. W. Barford. Rollers.
739. F. Warner. Cocks or taps.
776. R. M. Roberts. Obtaining and applying motive power.
911. W. Turner. Manufacture of dough.
1003. J. Lawson. Balling cotton and thread. (A communication.)
1012. W. Davies. Furnaces.
1015. C. Mather. Spittoons.
1030. H. Deacon. Manufacture of caustic soda.
1055. N. Nussey. Preparing and combing fibrous materials.
1065. F. Tolhausen. Telegraphic dial printing apparatus. (A communication.)
1101. J. Makay. Projectiles.
1113. J. W. Ford. Sewing machines. (A communication.
1244. W. T. Glidden. Restoring phosphatic guano. (A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated May 2, 1862.

2775. W. Hall.
2777. R. Fethney.
2779. E. Bowra.
2780. J. B. Love.
2783. H. Orth.
2787. A. Prince.
2789. F. H. Schroder.
2794. A. W. Williamson.
2799. J. Hancock.
2816. S. Hague.
2817. J. Fisher.
2844. L. F. Duval and L. A. Beaudet.
2845. M. Henry.
2848. J. Hodgkinson.
2854. T. Proctor.
2875. J. Nixon.
2883. J. C. Goodall and J. Beals.
2902. J. Hemingway.
2945. J. H. Johnson.
2990. W. Clark.
3029. J. Burrows and J. Dougan.
3127. E. C. B. de Beaulieu.
3142. E. C. B. de Beaulieu.
355. W. Lyall.
405. W. Avery.
509. J. Imray.

Dated May 6, 1862.

2797. T. Schwartz.
2798. H. G. Gibson.
2801. J. Barrow.
2809. J. Byrne.
2811. D. Cowan.
2813. G. Simpson.
2814. R. McNair.
2819. R. A. Brooman.
2825. F. O'Reilly.
2827. D. Y. Stewart.
2833. C. O. Crosby.
2847. T. B. Collingwood and A. Butterworth.
2851. E. C. Kemp.
2928. W. E. Newton.
2989. A. V. Newton.
3222. T. E. Vickers.
528. E. G. Bruzand.
567. J. B. Kendall.
583. H. Bunning.
587. B. Standen.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1067. R. Harrington.
1090. C. H. G. Williams.
1111. L. H. Blake.
1075. W. McI. Cranston.
1083. J. Toussaint.
1085. E. Francis.
1182. H. Clarke.
1092. T. H. Arrowsmith.
1109. W. Sellers.
1095. W. Bayliss.
1106. T. W. Miller.
1115. R. Mushet.
1123. J. F. Allender and D. Rowley.
1130. R. Mushet.
1131. R. Mushet.
1173. G. Bell.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

975. W. Hartley.
986. H. Lee and J. Gilbert.
988. M. A. C. Mellier.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending May 3, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
2136	1	0	2325	1	1	2335	0	3	2346	0	3	2356	0	3	2366	0	3
2301	0	3	2326	0	3	2336	0	3	2347	0	7	2357	0	10	2367	12	1
2317	0	6	2327	0	3	2337	0	3	2348	0	3	2358	0	9	2368	0	5
2318	0	3	2328	0	[illegible]	2338	0	3	2349	0	3	2359	0	9	2369	0	6
2319	0	7	2329	0	3	2339	0	3	2350	0	3	2360	3	10	2370	0	3
2320	0	3	2330	0	3	2341	0	6	2351	0	5	2361	[illegible]	3	2371	0	8
2321	1	7	2331	0	10	2342	0	7	2352	0	3	2362	0	9	2372	0	3
2322	0	6	2332	0	10	2343	0	3	2353	0	10	2363	0	5	2373	1	4
2323	0	7	2333	0	7	2344	0	7	2354	0	7	2364	0	3	2374	0	3
2324	0	3	233	0	6	2345	0	3	2355	0	6	2365	2	3	2375	0	3

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.		Nos. in Register.	Names and Addresses.	Subjects of Design.
Mar.	7,	1326	H. Appleton and Co. Eastcheap	Envelope.
,,	10,	1327	J. Bailey, New Kings-road, Chelsea	Cornet.
,,	18,	1328	L. Issacs, Duke-street, Aldgate	Cape.
,,	20,	1329	J. Michels, William-street, Knightsbridge	Beaufort plate.
,,	31,	1330	F. Zysel, Brook-street, Ratcliffe	Shirt.
April	2,	1331	W. Dennett, Park-street, Worksop	Measure.
,,	3,	1332	J. Hoy, Pickering-place Paddington.	Truss.
,,	9,	1333	W. Pearson, Washington-st. Birmingham	Brick.
,,	11,	1334	A. E. Sanson, Lower-road Islington	Chloroform inhaler.
,,	12,	1335	G. and W. Lake, Mott-street, Birmingham	Saddle bar.
,,	,,	1336	J. Timmins and Co., Brearley-street West, Birmingham	Oil can.
,,	14,	1337	G. L. Hunt, Ealing-lane, Old Brentford	Target.
,,	15,	1338	G. Adams, Stafford-place, Queen's-road, Pimlico	Railway beam.
,,	16,	1339	Herrington and Hale, William-street, Clerkenwell.	Instrument for finding the centres of circles, &c.
,,	22,	1340	F. M. B. Bertram, 4, Gower-street North	Label affixer.
,,	23,	1341	Rev. E. H. Kendall, St. John's-ter. Notting-hl.	Seat.
,,	24,	1342	J. Sayer, Upper-street, Islington	Shirt or chemise.
,,	25,	1343	C. Watts, Park-place, Paddington-green	Crane.
,,	26,	1344	H. Beckett, Studley	Crochet needle.
,,	28,	1345	M. Mendelssohn, Millbank-st., Parliament-st	Trowsers.
May	2,	1346	M. Mc Kay, Lower Essex-st., Birmingham	Pin.

PROVISIONAL REGISTRATIONS.

Mar.	7,	4451	G. Wing, Sheffield	Lining for [illegible] dishes.
,,	7,	4452	B. Nicoll, 4 Regent-cir.	Shirt collar.
,,	12,	4453	C. Topham, Bush-lane	Rotating brush.
,,	15,	4454	A. W. Banks, Newgate-street	Sponge bag.
,,	19,	4455	Mappin and Co., Oxford-street	Travelling bag.
,,	20,	4456	Nicholson and Evans, Sheffield	Parallel vice.
,,	26,	4457	Cottam & Co. Winsley-street	Ventilating [illegible]
,,	29,	4458	F. Mège, Wimpole-st.	Jewellery.
,,	31,	4459	T. Bianchi, Regent-pl. Birmingham	Chest fittings.
April	1,	4460	H. Hyman, Brmnghm.	Scarf ring.
,,	,,	4461	W. Patridge, R.A., Woolwich	Spring hair brush.
,,	7,	4462	Silver and Fleming, Wood-st. Cheapside	Fastening for purses.
,,	8,	4463	J. Bayley, New Kings-road, Chelsea	Cornet.
,,	,,	4464	J. Bayley, New Kings-road, Chelsea	Acoustics for musical instruments.
,,	15,	4465	H. F. B. Macnamara, Colchester	Ventilator.
,,	17,	4466	R. Stevens, Hungerford-market	Billiard table.
,,	22,	4467	W. W. Rouch, Strand	Photographic shutter.
,,	24,	4468	W. Spurrier, Birmingham	Egg frame.
,,	25,	4469	A. J. Marriott, Oxford-street	Safety [illegible] guards.
,,	,,	4470	A. Salomons, Old Change	Corset.
,,	28,	4471	J. M. Hagenbach, Caroline-terrace, Dalston	Cigar holder.
,,	30,	4472	T. H. and J. Smale, Gt. Marlborough-street	Lathe.
,,	,,	4473	R. & C. Cuff, Cockspur-street	Muzzle.
May	5,	4474	W. H. Blanch, Liverpool	Porte-[illegible]
,,	6,	4475	J. Tasman, Grocer's-hall-court, Poultry.	Trunk.
,,	,,	4476	J. Lamb and H. Holdsworth and Co., New George-st. Sheffield,	Clip.

PRICES CURRENT OF METALS.

London, May 8, 1862.

		£ s. d.		£ s. d.
IRON:				
Rails in Wales and North of England	pr. ton	5 0 0	to	[illegible]
Welsh Bars, in Wales	,,	5 5 0	,,	[illegible]
Staf. Bars, at the Works	,,	5 10 0	,,	[illegible]
,, Hoops	,,	7 10 0	,,	[illegible]
,, Sheets, Singles	,,	8 0 0	,,	[illegible]
,, Nail Rods	,,	6 15 0	,,	[illegible]
,, Boiler Plates	,,	8 0 0	,,	[illegible]
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 11 3	,,	[illegible]
Do. No. 1, Good Brands	,,	2 11 6	,,	[illegible]
Scotch Bars	,,	7 5 0	,,	[illegible]
Swedish Bars, in London	,,	13 10 0	,,	[illegible]
COPPER:				
Sheet and Sheathing	per lb.	0 1 11	,,	[illegible]
Tough Cake and Tile	pr. ton	98 0 0	,,	[illegible]
Best Selected	,,	101 0 0	,,	[illegible]
Australian	,,	99 0 0	,,	[illegible]
South American	,,	[illegible] 0 0	,,	[illegible]
Yellow Metal Sheathing	per lb.	0 0 8½	,,	[illegible]
STEEL:				
Swedish Keg	pr. ton	15 0 0	,,	[illegible]
,, Faggot	,,	10 0 0	,,	[illegible]
TIN:				
English, Block	p. cwt.	6 1 0	,,	[illegible]
,, Bar	,,	6 2 0	,,	[illegible]
Foreign, Banca	,,	6 4 0	,,	[illegible]
,, Straits	,,	6 7 0	,,	[illegible]
TINPLATES:				
Charcoal, I.C.	pr. box	1 4 6	,,	[illegible]
Coke, I.C.	,,	1 2 6	,,	[illegible]
LEAD:				
Pig, English	pr. ton	19 15 0	,,	[illegible]
,, Spanish	,,	19 0 0	,,	[illegible]
Common Sheet	,,	21 10 0	,,	[illegible]
Tea ,, [Wimshurst's Patent] A special discount	,,	35 0 0	,,	[illegible]
SPELTER:				
On the spot	,,	19 10 0	,,	[illegible]
For arrival	,,	19 5 0	,,	[illegible]
ZINC:				
English Sheet	,,	24 0 0	,,	[illegible]
QUICKSILVER	pr. btl.	7 0 0	,,	[illegible]

JAMES LAURIE, Metal Broker,
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 16, 1862.

THE SPITHEAD FORTS.

The capture, or rather surrender, of New Orleans—for at the last accounts, the Federals had not entered the city—is a remarkable illustration of the utter insignificance of forts for the defence of a port or river. The approach to the city, up the Mississipi, is defended by Forts Jackson and St. Phillip, standing on opposite banks of the river, which is here one thousand yards wide. These forts are protected by earthworks, and together mount nearly 300 guns. Any vessel attempting to pass between them would be exposed to a galling and formidable fire at ranges which could not be more than 500 yards, and probably would be 300 to 400 yards, any of which ranges is most effective for destructive battering power. The proposed Spithead Forts could not be more advantageously situated for the defence of Portsmouth from an invading force seawards. The Confederate garrisons which manned the forts were constantly on the alert by night and by day, and yet four or five Federal gun-boats contrived to slip past the forts in the dark, or to run the gauntlet of their fire unharmed; and meeting with no force afloat to oppose them, those armed vessels presented themselves before the great, wealthy, and populous city of New Orleans, which, on the mere menace of bombardment, had no alternative but to surrender at discretion.

The manner in which the Federal flotilla made its approach, and placed the city at its mercy, are most instructive, and quite to the purpose in considering the Spithead Fort question. They first opened a shell fire against the forts from a distance of nearly two miles. The forts could only reply with rifled guns, which at this long range do not appear to have produced any damaging effect on the gun-boats, although these were wooden vessels. Iron-clad vessels would have received the fire of the forts even at short range with impunity, and have passed up the river with greater facility.

If the Confederates had been provided with two or three iron-plated floating batteries, the case would have been very different. Moored in the stream in a line across the river, and only 200 or 300 yards apart, it would have been impossible for the Federal vessels to escape their vigilance, and if in the darkness of night some of the latter had been so bold and lucky as to creep past the line of defences, the floating batteries would, at the first signal of alarm, have followed and destroyed the enemy. But the invading squadron, if not of sufficient force to engage the floating batteries in close action, would not attempt a foolhardy exploit which would expose it to certain destruction.

In a former article we pointed out the distinctive character of the two systems of harbour defence. The nature of the difference is so simple, and so self-evident, it appears almost insulting to the plainest comprehension to point it out. Land forts are immovable. They have their ranges of fire, which are fixed and unalterable. Vessels having passed or keeping out of those ranges cannot be molested by the guns of the forts. With the vessels of a bold and enterprising enemy hovering about the coast, it is impossible to prevent some of them in the mist of the morning or the dusk of the evening slipping past the forts, which cannot follow the enemy. Floating defences, as we have shown, can effectually bar the passage to an enemy's ships. Here, in a few words, is the whole argument with reference to the Spithead Forts, the construction of which, with the experience we now possess, would be a culpable act of folly.

THE INTERNATIONAL EXHIBITION.

THE WESTERN ANNEXE.

No. II.

The advancement made in regard to the arrival, disposition, and completion of machinery to be put in motion since our last number was published is marked. Still, much remains to be done, and the busy hum of workmen engaged in "closing rivets up" scarcely ceases during the working hours of each day. Presently the whole of the moving machinery will justify the term applied to it, and we shall then have realized "sights and sounds" most grateful to the eye and pleasant to the ear of the true mechanic. There is a rude harmony in the sounds of machinery in motion, paying strict attention, as it does, to time and tune, which has its charms for those who are susceptible to them. In the whirring and buzzing of the lathe and loom there is always sweet music to the ears of manufacturers; and it is to that kind of music that the nation might joyfully dance, for it has had much to do with our national greatness.

Turning, however, from romance to reality, we owe it to one eminent firm, who exhibit in the Western Annexe, to make reparation for the accidental omission of detail in regard to the machinery they display. We spoke then of several of the fine specimens of marine engineering which are to be found at the British end of the Annexe, and we now beg to direct public attention to a pair of marine engines exhibited by Messrs. John Penn and Son, of Greenwich. These are excellent exponents of the workmanship of Messrs. Penn. They are on the direct acting principle, and are intended for a screw steam-ship. The engines are of the collective power of 600 horses, and have been manufactured for the Spanish Government. The cylinders are 78 inches in diameter, and the length of the stroke is 3 feet 6 inches. The connecting rods are 9 feet long. Several pairs of engines of a nearly similar character have been made for the respective navies, and they have been found to work with perfect smoothness and regularity. Much of this latter is due to the system of counterpoising the crank shaft pursued by Messrs. Penn; and we may say in passing, that it would be well if more attention generally were paid by engineers and machinists to the proper balancing of running machinery. Much of the jarring and tremor, so disagreeably felt on board steamers, and so hostile to the stability of buildings, is due to the want of a proper mode of balancing those parts of the engines or machinery which are of unequal weight.

Returning to the engines of Messrs. Penn, it may be further said that each condenser is provided with a double acting air pump 23 inches in diameter, the length of stroke being the same as that of the piston. The engines occupy a space 28 feet in breadth by 18 feet in the direction of the length of the vessel.

Engines of the same kind of construction as these, but of 1,250 H.P., are in course of construction by the firm named. These are intended for H.M.S. Achilles, now being built in Chatham dockyard, and one of the cylinders belonging to the Archilles' engines is exhibited in the annexe. It is a fine and clean casting, well bored out, and its weight is 18 tons. The inner diameter is 42 inches, the stroke will be 4 feet.

Messrs. Penn also exhibit, in near neighbourhood to the cylinder, a massive wrought-iron crank shaft for the same engines, as also a connecting rod, fitted complete with brasses. The Warrior and Black Prince were furnished with engines of which those of the Achilles will be duplicates. Before advancing further through the annexe, we may state that Messrs. Penn are at present engaged, also, in making two pairs of engines for the new iron sided ships Northumberland and Minotaur. A cylinder cover belonging to one of these is shown, as are some iron castings from the mould, and others which have passed under machine tools.

Of the half-dozen locomotives placed in the annexe, so much has already been said elsewhere that it seems almost unnecessary to refer to them further than to endorse the favourable accounts given of them. They are all admirable specimens of the progress and improvement which have been made during the past dozen years in railway economy, and they reflect credit on the companies and firms who have manufactured and sent them to the Exhibition.

Models of a pumping-engine and safety-balance valve, as erected and used at the Lea-bridge branch of the East London Waterworks, are exhibited by Messrs. Harvey and Co., of Hayle, Cornwall. Having seen the originals of these we can vouch for the fidelity of the models. The Lea-bridge engine, which was erected by Messrs. Harvey some five or six years since, was at the time of its erection the largest in or near London. When working full-power it pumps 9,000 gallons of water per minute to a height usually of 140 feet. The water thus raised is conveyed into London by means of cast-iron pipes 36 inches in diameter. The whole of the system of pumps, reservoirs, filtering beds, sluices, &c., at Lea-bridge is well arranged, and everything there is on a gigantic scale.

In 1858 Messrs. Harvey and Co. erected, for the Southwark and Vauxhall Water Company, at Battersea, a pumping-engine, the cylinder of which is 112 inches diameter, and weighs 36 tons. This engine, though the largest and most powerful ever built for such a purpose, is of the most simple construction. The steam valves are all on the equilibrium principle, and the arrangement of parts is throughout such that this colossus of engines, so to speak, is as completely under the control of a pigmy, but intelligent engineman, as is the small engine in a factory.

The quantity of water pumped up for the supply of London daily amounts to 115,000,000 gallons. Of this enormous quantity 79,000,000 of gallons are pumped by means of single-acting engines on Harvey's plan. In fact, the reputation of this firm for gigantic pumping-engines is world-wide. Those who have time to visit Battersea and Lea-bridge, where the originals of the models referred to exist, would find that they were amply repaid for their trouble by an inspection of them.

Speaking of waterworks we are reminded of the fine specimens of fire-engines exhibited in the Western Annexe. And after the experience of the past year or two in the Metropolis in respect to fires, and the recent report of the Select Committee which has sat on the subject, he must be a bold man who will say that fire-engines are not an important feature in the world's show at Kensington. Every witness examined, including the [illegible] of th [illegible] Brigade, has admitted [illegible] sin [illegible] asserted—that the pres [illegible] st engines and stations [illegible] the protection of Lo

An altered and expanded arrangement in respect to the London Fire Brigade, will unquestionably demand a commensurate improvement and increase in the number of fire-engines. Of steam fire-engines, the metropolis has but a scanty supply, and we suggest that attention should be paid to the subject by engineers and others interested in it.

Messrs. Shand and Mason, Roberts, Merryweather, and others, figure the most largely in this department, but, as we have said, the display is meagre. The American steam fire-engine, forwarded by Mr. Hodges, of the Lambeth Distillery, we have before spoken of, but why it should be placed in a corner, where it is difficult for its merits to be disclosed, is a question for the Commissioners, whose ways are difficult to comprehend or account for.

THE EASTERN ANNEXE.

No. I.

THE interior arrangements of the Exhibition are at length assuming something like a complete and sightly form. Many of the inartistic and meretricious "trophies," which at the opening disfigured the nave, and marred the general beauty of the scene, have disappeared therefrom, and the Commissioners, profiting by the suggestions of the scientific and general press, have made many other alterations, which are manifest improvements. Probably, therefore, by the first "shilling day," the *tout ensemble* will have attained its grandest phase, and the public will then obtain full value for their admission money. Better had it been, perhaps, had the ceremonial of inauguration been deferred till the 1st of June. The cutting criticisms which have appeared on all hands, would thus have been spared, and the smartings which they have produced avoided. "All's well that ends well," is a proverb true as it is trite, however, and there is much hope in store, therefore, for the Commissioners of the International Exhibition. The beginning has been ill, but the ending may prove "well," and thus there is "balm in Gilead."

Presently we shall wander "at our own sweet will," through the labyrinths of art, of science, and of industry, which the nations have created for the general weal, and culling such choice flowers from each as may enlist our notice most strongly, shall from time to time present them for the acceptance of our readers. Perhaps the Eastern Annexe is, as a whole, one of the most satisfactory departments of the Exhibition —industrially speaking. It is well arranged, and taken alone forms an excellent exemplification of the progress and present condition of agricultural and horticultural science in England. The steam-engine, which had already effected so much for the material comfort and moral welfare of the people of this favoured land, by impelling machinery, and in the varied processes of manufacture, and in transporting people and merchandise from place to place— the mighty and yet delicate steam-engine is shown in the Eastern Annexe to have become also the chief cultivator of the soil. To its irresistible power the stubborn globe is now made to yield its richest treasures, and the golden harvests bow in due season to "its sturdy stroke." The application of steam to the tilling of the ground is, indeed, one of the proudest achievements of modern time. The eleven years which have elapsed since the existence of the glorious palace of iron and glass in Hyde Park, have developed rapidly the arts of husbandry, but whilst in the Eastern Annexe of the present Exhibition, we are made pleasurably aware of the fact, we find there also sure promise of yet further advancement. Machines and implements, eloquently telling of the skill of those who contrived them, are there to be seen in the greatest profusion, and these are witnesses, too, to the mechanical superiority of Englishmen. Among the prominent objects in the Eastern Annexe is a very handsome specimen of an agricultural lomomotive engine. This, as its name implies, is a giant labourer, capable of being employed in any operations on the farm, and who will go on puffing and working without grumbling, so long as any work remains to be done, and his employer provides him with his daily water and coals.

Mr. Aveling, of Rochester, Kent, is the maker of this farmers' assistant, which has embraced in its composition many novel points and peculiarities. It has an extra large boiler fitted with thirty-seven two and three-quarter inch tubes. The external plates are of the best Butterly iron, whilst the fire-box and tube-plates are of Bowling iron. The boiler is judiciously "stayed" in a very strong manner so as to resist high-pressure. The fire-grate measures 31 inches by 34 inches, and may be fed with wood where that material is found most accessible. The cylinder, of 10 inches diameter, is surrounded by a jacket, and, being placed on the forward part of the boiler, priming, which sometimes occurs in ascending steep gradients, is thus prevented. The crank-shaft is made of the well-known Low Moor iron, which for such purposes has gained especial and deserved fame. The engine is fitted with improved governor, patent tender, and water tank, under foot-plate, driving chain and gear, steam-pressure guage, secret, as well as open safety-valve, and other minor appliances. The driving wheels are 5 feet 6 inches in diameter, and 12 inches wide. Altogether it is a well arranged and compact machine, remarkable for its simplicity and strength. It is said to be capable of drawing ten tons up a gradient equal to 1 in 6, and is easily managed by an ordinary engine-driver.

Messrs. Barrett, Exall, and Andrews, of the Kates-grove Iron Works, Reading, present, further on, some admirable specimens of workmanship in the shape of steam, and horse-thrashing machines, engines, mills, and agricultural machinery generally. Of reaping, mowing, and thrashing machines, haymakers, &c., Burgess and Key, of Newgate-street, present some excellent specimens. They are placed on the west side of the Eastern Annexe. This firm have, we believe, received more prize medals for agricultural implements than any other firm in England, and this fact speaks trumpet-tongued of the excellence to which they have attained.

In the matter of steam ploughs and a great variety of other implements for the cultivation of land and the gathering in of its fruits, Messrs. M. Garrett and Son, of Leiston Works, Suffolk, and James and Frederick Howard, of Britannia Ironworks, Bedford, are large exhibitors. The first-named firm have erected a stand for the display of their wares, and which discloses a considerable amount of artistic skill on the part of its constructor.

Messrs. Ransomes and Sims, of the Orwell Works, Ipswich, are very largely represented on the West side of the Eastern Annexe, both as regards steam engines and apparatus for agricultural purposes, and implements to be worked by horse or manual labour. Indeed, it would be almost an impossibility to barely enumerate the specimens which they have sent to the Exhibition. Perhaps their 15 H.P. horizontal stationary high pressure steam engine is the best exponent of their ability as engineers. The boiler of this is on the Cornish principle, the fire being placed in an internal flue. The flame passes first through, and then along each side of the boiler to the chimney. This arrangement is calculated to generate steam rapidly, whilst any sediment contained in the water used will collect *under* the fire flue—a great practical advantage—because the deposit in that case will not interfere with the generation of steam. There is an air of substantiality about engines of this construction which speaks well for their continuing long in good condition. Mounted on a stone base, to which the bed-plates are firmly bolted, an engine of this kind would be admirably adapted for working machinery of almost any kind, but for thrashing machines, saw, or corn mills, it would be especially useful. The improvements made in horse ploughs—the judicious combination of lightness with strength—are seen in the specimens of Messrs. Ransomes and Sims.

Of traction engines and highway locomotives there are several varieties. Those of Robey and Co., of Lincoln, are not the least excellent of them.

Of thrashing machines there are many varieties; but one exhibited by Tasker and Sons, of the Waterloo Iron Works, Andover, Hants, calls, perhaps, for especial notice at our hands. It is patented, and known as the Combined Thrashing Machine. It performs, indeed, a number of distinct operations, as separating the corn, straw, caving, and chaff, from each other, and depositing them in the place assigned to each. It is, indeed, a favourable example of the ingenuity of the firm who have deposited in the Annexe.

A double corn mill, fitted with two pairs of stones, is shown by Mr. John Tye, of Lincoln. Its portability is one of its highest recommendations. It may be transported from place to place easily, and is workable by steam, wind, or water power. Infinite, however, are the treasures of the Eastern Annexe, and many of them must be left unexplored and unexplained until a further opportunity for doing both presents itself.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER XII.

REED'S WOOD AND IRON SHIPS.

THE article in the last Magazine on iron-clad ships of Reed's composite class, requires special notice. We are threatened, not with a re-construction of the navy, but with the re-adoption of a vicious and exploded system, on a false pretence. The purpose of the Admiralty, if the scheme be carried out, is to build a fleet of sloops, corvettes, and gun-boats of timber, partially cased in iron. A more flagrant evasion of the vigilance of the House of Commons was never attempted, and I should ill discharge my duty as the advocate of "Iron Walls," if I did not warn the public against the deception.

It is not for me to expect you to disclose the source of the information published in your journal, with reference to Mr. Reed's singular design; but I shall not be far wrong in assuming that it comes from the fountain-head. It is a point gained to bring favoured projectors and official patrons to the bar of public opinion, and I am satisfied that the MECHANICS' MAGAZINE should be the court in which they are tried. Mr. Reed, I trust, will not take anything I say as personal. He is the partizan of wood.[*] I am pleading the cause of iron. Within the last week sundry bits and scraps of naval intelligence, no doubt inspired by Mr. Reed himself, have affected to describe the plan of construction of the Enterprise; but the statements published are so vague, they give no definite notion of the plan, and certainly they do not disprove the statement you published, that "his method of armour-plating will not "keep out solid shot." A simple denial, and a flat contradiction, are not proofs. Evidently, Mr. Reed evades the real question—he tells us he protects the *vital parts* of the ship, which proves that he leaves some parts unprotected. If solid shot can 'penetrate any part of the structure, then an opening will be made through the armour, and shell can follow. Virtually, in an action at close quarters, a ship partially protected will not be protected at all.

---

[*] We believe our correspondent misrepresents Mr. Reed in this particular. We have hitherto considered Mr. Reed more an advocate of iron than of wood.—[ED. *M. M.*]

From the inquiries I have made, and Mr. Reed's own published statements, I can give a pretty correct description of the Enterprise, but it is not easy to be very precise, when the plan itself, at the hands of its promoters, is undergoing almost daily changes. The important issue, "power or speed for the navy," raised in your columns, has attracted much attention in naval circles, and even Mr. Reed admits the principle I contend for, by hastening to assure us that the Enterprise is not to be a fast-going ship. He moderately contents himself with giving her nine or ten knots an hour, and confesses that he has made this concession in deference to "the wishes of our most able and experienced naval officers." If this were the only point of controversy, I might be satisfied, but there are other serious defects in the proposed structure.

Nobody but Mr. Reed has a perfect knowledge of his plan, and he himself is in doubt on some points. But its general features have permeated through official walls, and are as well known to some foreign governments as to the Admiralty itself. It is absurd to suppose information of this kind can be kept secret. The following is a description of the principal points in the construction of the Enterprise. The chief aim of the projector was to produce armour-plated sailing cruisers with as great an amount of speed under sail or steam as possible; but sailing speed was the main object. He turned his attention especially to that point, and his endeavours to effect it exhibited much ingenuity. This is precisely the kind of work for which his skill as a naval draughtsman is well adapted. Notwithstanding Mr. Reed's denial, he made speed the prime condition of his design, and in the sequel it will be found that the description just published in the Mechanics' Magazine is substantially correct. Mr. Reed, knowing perfectly well the tendency of the deep-rooted *traditions* (as they are termed) of the Controller's Department, adopted "Speed and Wood" as the conditions of his plan. He faithfully adhered to them, and the result is a compromise, in which power is sacrificed to speed.

The guns, four in number, are placed on a line along the centre of the deck, leaving spaces between them for the masts and funnels. They are simply pivot guns mounted on a platform, and protected with shields. Two are so fixed amidships, and one at the bow and stern.

The arrangement is similar to that of the cupola ship, the only difference being, that in the former the shields, as well as the pivot guns, are mounted on the deck, whilst in the latter only the roof and a part of the sides of shields are above the deck. I would advise those who take an interest in the subject to view the models, at the International Exhibition, of Cole's cupola ships and of Mare and Co.'s beautiful model of the Northumberland, on the deck of which a pivot gun is mounted at the bow and stern. An inspection of the two models (adding iron shields to protect the pivot guns) will convey a correct idea of the two plans to the observer's mind, and render the difference between them clear and intelligible. The two guns amidships are what Mr. Reed calls his broadsides. They can be fired simultaneously in any direction; but, of course, as broadsiders, they can only be fired on one side at a time, and, in fact, they, as well as the other two guns, only possess the ordinary range of pivot guns, which is perfectly well understood by naval men. In this respect there is no novelty.

Mr. Reed, having placed his four guns in the manner described, arranges spaces fore and aft as temporary cabin accommodation for officers and crew, and makes the vessel a sea-worthy cruiser, so that she can sail or steam to distant stations, and, by removal of the temporary cabins, be converted into a fighting ship in a short space of time.

Stripped of all exaggeration the Enterprise is a sloop of war constructed of timber partially protected with armour plates, and armed with four pivot guns. But she is a *wooden ship*. Now here is the deception I complain of. If in spite of the opinion of the first scientific and practical talent in the country which has for years been devoted to iron-shipbuilding, if in opposition to the strong convictions of the economical school, who regard the construction of iron ships as the only means of reducing the naval estimates, and if, notwithstanding the assurances given by Ministers to both Houses of Parliament, that Governments were converts to those convictions, a major part of our ships of war are still to be built of wood, I will ask what is the use of Parliament, and how are public interests to be protected?

Here is another example of the necessity which exists for the appointment of a competent and independent iron armour-plated ship commission. There is no question which requires a more thorough and searching investigation. It is not understood in any department, and at the Admiralty it has little chance of fair and impartial consideration.

The idea of placing the weight of the armament and shields along the centre of the vessel, fore and aft, is borrowed from Captain Coles. It is the essential principle of his mode of constructing a man-of-war, of which the cupola is only one of the details. It may be an improvement, or the reverse. I will offer no opinion until I review the cupola system, to which, *per se*, there are serious objections.

The further details published on Mr. Reed's authority are extremely meagre; but they leave little doubt as to their real character. "The "armour plates will be 4½ inches in thickness, "and will be backed up with at least 18 inches "of solid timber." He does not explain whether the timber is supported inside by an iron skin and iron frames; but the *Times* reporter is more communicative, and informs us that "the *timber* frames, planking, shelf-piece, "and waterway of the vessel will be made to "serve as backing for the armour, which will "be equal in resisting power to that of our "largest ships." From this description, it is apparent there will be no iron skin or frames inside the timber, and yet Mr. Reed coolly asserts that the strength of the armour on the sides "will be equal to that which has hitherto "been employed in the iron-cased ships of the "Royal Navy."

By this artifice of language, he leads the reader to suppose that the armour of the Enterprise will be equal in resisting strength to that of the Warrior. There is an armour plate 4½ inches in thickness, and a timber backing of 18 inches. But no notice is taken of the Warrior's iron skin and frames, which constitute, in combination with the 4½ inch plate, the real strength of her armour. In the construction of the Warrior, the 18 inches of wood backing is not an addition to that strength—it is a source of weakness and a defect. But for the resistance of the iron frame of the Warrior, the teak backing, if not penetrated, would be splintered through and through by the 68 and 110-pounders. So will it be with the oak backing formed by the sides of a timber-built ship. The experiments at Shoeburyness have proved the immense superiority in point of resisting strength of an iron frame, and the weakness of a wooden frame. Every practical man who understands the question is exercising his skill and ingenuity to ascertain the best method of constructing ships and naval armour without wood as a material, either in the structure of the ship or as backing. Government, at a great expense, are making trials of plans having that special object in view. Mr. Reed steps in, sets at nought all this experience and foresight, and proposes—what? *To go on building men-of-war with timber, and protect them partially with armour plates.* If this plan were simply an experiment, I should not bring it so prominently into notice; but if we are to believe its author, it is intended to be applied as a system for perpetrating the construction of wooden ships; and his statement appears to be confirmed by the fact that he has received the appointment of inspector of the construction of this particular class of vessels.

We ought to know whether Mr. Reed represents himself or the Admiralty. In his letter to the Mechanics' Magazine, he says a statement published in its columns is "wholly unauthorised." Are then all the statements published by himself authorised by Government? In so serious a matter the public ought to be enlightened on that point, and I trust some member will see this matter to be of sufficient importance to rise in his place in the House of Commons, and ask what dependence is to be placed by the reports which have been published during the last ten days, on the subject of the Enterprise class of armour-plated war ships.

I must now refer to two or three of your correspondents' plans of armour-plating submitted.

Mr. Hall's and Mr. Gearing's are of a class of which I have given several examples, including the Thorneycroft, Plum, and Scott Russell's inventions. The plates are fastened to the ship's side, but they are not drawn or held taut, and close-fitting all over their back surface. They are kept in their place like a slate in a frame, but there is no arrangement to keep the plate immovable, and prevent vibration. Perfect immobility of the plate is indispensable. It must not only be secured to the side of the ship, so that it cannot fall off, but it must be laid hold of by the fastening, and drawn to a hard and rigid bed, affording an even bearing to the plate over its entire back surface. If this be not accomplished, vibration, when the plate is struck by shot, becomes the source of destruction. The correctness of this rule is proved in a remarkable way, by two experiments at Shoeburyness. In one case a plate only 2½ inches thick, held immovably on an iron backing, suffered no damage from a 110-pounder shot, whilst in another case in the trial of a target composed of three five-inch plates, bolted together, and making a total thickness of fifteen inches of solid iron, the plates were broken by projectiles of less power. There is no instance of an iron plate being penetrated through and through by a projectile, unless the backing has yielded, or it has been unsupported by any backing. The penetration of the iron and the fracture of a plate are two different effects, about which extremely vague notions are entertained. The thickest plate may be cracked and broken into fragments if it oscillates, no matter in how small a degree. Through bolts are used to fasten armour plates, because, although an imperfect and most objectionable fastening, they hold the plates better than any other known method, but still they do not hold the plates firm and steady.

I have said all this before, but I am obliged to repeat it, because every week brings a number of plans in which the radical error I have just referred to exists. Some twenty inventors have conceived the idea of fastening plates together by means of flanges turned back at right angles at the ends are welded to the back of the plate, and fastened together by bolts or keys. That is Mr. Hall's and Mr. Gearing's method, which holds the plate securely and protects the fastening from impact, but it affords no means of drawing the plate firmly to a backing.

I will not, for the future, occupy your valuable space, or fatigue your readers, by noticing plans of the class referred to, or, indeed, any other which do not offer some new and practically useful feature.

A Civilian.

SMALL CHANGE.

The Royal Mint is engaged at present in the production of a large quantity of very small coins. These are not, however, intended for home circulation, but for service in the colonies. For our West Indian possessions, for example, the mint presses are creating silver pieces each of the value of three-halfpence, and, elegant as these are in appearance, they support the idea which we have more than once expressed, that silver coins of less value than the threepenny-piece might well be employed in Great Britain and Ireland. The West Indian three-halfpenny piece has for its obverse a miniature portrait of Her Majesty, with the superscription usual on our own silver currency, and for its reverse a wreath of oak leaves surmounted by the imperial crown, and encompassing the value, 1½d., and the date, 1862. It is said that the dark-complexioned inhabitants of the West India islands have an insurmountable dislike to vulgar copper or bronze money, and that hence the British Government, in order to humour their prejudice, supplies them the small silver coins of which we speak. For the Ionian Islands the Mint is also occupied in the manufacture of small coins, but these consist of both copper and silver. The currency of these islands is as peculiar as is said to be the manners and customs of their inhabitants. The ancient Greek name of "Oboli"—familiar to readers of the beautiful story of "Belisarius"—is still retained in connection with the coinage. The Oboli piece has a value equivalent to one-tenth only of the English penny. It is of copper, and some idea of its dimensions may be gained from the fact that one pound weight of that metal is converted at the Mint into 240 Oboli. This diminutive specimen of mintage has for an obverse the emblematic Britannia seated on a rock with shield, trident, and other "properties." For its reverse a remarkable animal, in the form of a winged lion, does duty. This spirited and fierce-looking quadruped holds in his right paw "a quiver full of arrows." The quiver is decorated by a Greek cross, and a halo or "glory" surrounds the head of the lion. The inscription in Greek is simply "Ionian Islands," and the date is placed in the *exergue* below the lion's feet.

The Ionian silver coins are of the size, weight, and value of the British threepenny-piece, and represent, therefore, thirty Oboli. The obverse consists of the afore-named Britannia, whilst the reverse is made up by a wreath of oak leaves, enclosing the figures 30, and surrounded by the words in Greek, "Ionian Islands." The notion that living is cheap in those classical islands is much favoured. by finding that coins equal only in value to the [illegible]th part of an English shilling are useful there. What would the butchers and bakers of our own country, who rejected with scorn Sir Robert Peel's half-farthing, say to the Oboli of the Ionians?

Persons subsisting on small annuities might do well to inquire further into this matter. At home a penny loaf always costs, it is said, a penny. What, if in Corfu, Cephalonia, or Zante, a penny loaf may be obtained for an Oboli!

GOLDMINING AND THE GOLD DISCOVERIES MADE SINCE 1851.[*]

By John Arthur Phillips.

It would be obviously impossible to attempt to give, within the limits of the present paper, a detailed account of all the valuable gold discoveries which have been made within the last ten years, and I shall therefore necessarily confine myself to the more important only, but shall at the same time briefly notice various modifications which experience has introduced into the processes for treating auriferous ores, and succinctly advert to some of the causes which have unfavourably influenced this class of industry.

Gold is usually found in a quartzose gangue, traversing altered palæozoic shales, and these deposits are frequently richest in the vicinity of eruptive rocks. The oldest stratified rocks have been seldom found auriferous, but the sedimentary deposits which follow in the series (*i.e.* those generally ascribed to the Silurian, Devonian, and Carboniferous epochs,) have, particularly when highly metamorphosed, yielded the largest amounts. Of these, those usually described as Silurian rocks have been by far the most productive, but instances are not wanting, even in Europe, of small quantities of the precious metal having been found in the conglomerates of the Carboniferous period.

Gold almost always, if not always, occurs in the native or metallic state; generally in the form of small flakes or granules, but occasionally in masses of considerable weight. It is never pure, being invariably alloyed with silver, and frequently contains small proportions of iron and copper.

Gold is also often associated with various metallic sulphides, such as copper pyrites, galena, blende, and particularly with iron pyrites, and mispickel. It appears somewhat doubtful whether, in every instance, all the gold in metallic sulphides exists in the form of minute metallic particles, or if, in some cases at least, it may not be present in combination with sulphur. I may however observe, that from the results of numerous experiments on this subject, I am inclined to the belief that gold does sometimes occur in small quantities in the form of sulphides, but that oxide of gold, for the extraction and utilization of which sundry much vaunted processes have been devised, does not exist in any of the known auriferous ores.

The extraction of gold from the sulphides would, by the ordinary process of amalgamation, present considerable difficulty, and consequently it will often be found advantageous to separate and collect the pyrites, &c., contained in the tailings, and subsequently to subject them to metallurgic treatment by fusion either with galena, litharge, or some other lead product.

The most important gold discoveries made during the last ten years are those of British Columbia, New Zealand, and Nova Scotia; but it may also be observed, that gold in paying quantities has been recently discovered in the neighbourhood of Dolgelly, in North Wales.

British Columbia.—As early as June, 1856, Mr. Douglas, the Governor of Vancouver's Island, reported to the Secretary of State the discovery of gold in the British territory, north of the 49° of latitude, and stated that the earnings of the diggers ranged from £2 to £8 a day. In consequence, however, of the hostile attitude assumed by the natives, the number of diggers was very limited. Altogether this discovery attracted at first less attention than might have been anticipated, but in December, 1857, Governor Douglas reported that the Indians themselves were extensively engaged in the search for gold, and that the accounts which had reached the neighbouring states of America had caused considerable excitement. It was not, however, until May, 1858, that a stream of immigration sufficient to overpower the opposition of the aborigines had fairly set in, and the British public learnt, for the first time, that the mainland of new Caledonia, as the district extending from the Red-river to the Pacific was somewhat vaguely designated, was a rich and beautiful land, which gave every promise of becoming a flourishing and highly important colony.

The *Times* correspondent, writing from Victoria, Vancouver's Island, under date of January 20th of the present year, says:—"Beginning with Fraser River, the main artery of the auriferous region, I may state that gold is known to exist, and has been worked at a great many places in the river and on its banks, from a point about 45 miles from its mouth up to near its source in the Rocky Mountains; in other words, from the 49th up to the 53rd parallel of north latitude, a distance (taking in the windings) of some 800 miles. The south branch of the Fraser has its sources near Mount Brown, in the Rocky Mountains, in about 53° north latitude, 118° 40′ west longitude. Thence this branch flows for 290 miles to Fort George, a post of the Hudson's Bay Company. The north branch rises in an opposite direction. It receives its supply from a series of lakes lying between 54° and 55° of north latitude; longitude about 124° 50′ west, and runs a course of 260 miles to its junction with the south branch, some miles below the 54th parallel of north latitude. Here the union of the two branches forms the Fraser River proper. Adding the north branch, which is also a gold-bearing stream, and which was worked last season, to the other arm, the two will give us a continuous stretch of auriferous riverain territory upwards of 1,000 miles in length, extending for many miles back into the country, but not including the tributary rivers which fall into the Fraser. In short, the river itself is now known to be auriferous, and to pass through a gold bearing country throughout its whole course. Gold is also found in most of the tributaries of the Fraser, of which no less than 59 are known. The great length of the main river, and the number of its tributaries, will give some idea of the auriferous resources of the country,

"But these facts do not by any means convey a comprehensive or accurate view of the vast extent of the area of the goldfield, because they are limited to the central portions of the country, while the whole of the upper portion of British Columbia, from its southern to its northern boundary, is auriferous.

"Besides the gold found in the beds and on the shores of these streams, the Fraser itself and many of its tributaries are skirted and bordered by terraces, all of which yield gold also. These terraces, or benches, as the miners call them, run at intervals along both sides of the rivers for miles in length, and they recede where the mountains retire for distances back into the valleys, varying from a few acres to a few miles in breadth. They are objects of curiosity and speculation, and add much to the beauty of the rude scenes in which they occur, from the regularity and evenness of their structure. They generally occur on both sides of the river (opposite to each other) at the same place, sometimes at the same elevation on both sides, sometimes at different elevations, high on this and low on the other side of the river, and in some places they are multiplied into several successive level parallel plateux, rising one above the other as they recede from the bank. These terraces are composed of the ordinary alluvial deposits, loam, gravel, stones, sand, and boulders, and they are thick masses rising generally to a height of 150 to 200 feet."

---

[*] Paper read at the Society of Arts on Wednesday, May 14.

From the statement of the same writer, there would also appear to be abundance of gold found in other localities besides the vicinity of the Fraser. Large yields have been obtained from the diggings between Fort Hope and Fort George about 100 miles from its mouth. These mines are said to have yielded during the last season an average of 17 dols. to the hand, and a party of three men took from three days' diggings 240 dols. At Okanagan, sixty miles distant, the average produce is stated to have been 4 dols. to the hand. The Thompson River and its tributaries had also proved highly auriferous. North River gave from 8 dols. to 10 dols. to the hand, and on the Barrière a community of French Canadians made each as high as 60 dols. per diem.

Cariboo, however, appears to be the largest and richest of all the gold districts hitherto discovered. In confirmation of this it may be stated that at Steele's claim, William's Creek (Cariboo), a company of five partners commenced their operations during the summer months. They began their preparations by sawing timber for their sluices, and at first their claim did not promise as much as many others. During the first three days they obtained little or nothing, but on the fourth day their labours were rewarded by the collection of 4 ozs. of gold. On the fifth day they made 10 ozs., and on the sixth 41 ozs. From that time the yield went on increasing until it reached 387 ozs. a day, whilst the last day's work gave a return amounting to 469 oz. The five partners employed four hands to assist them in clearing away the tailings. The labourers were paid 8 dols. per day each, in addition to their board, and the total value of the gold raised during not more than two months' actual work was equal to a money value of £21,875. The total area of the claim so worked was 80 feet by 25 feet, thus showing the extreme richness of some of the deposits of British Columbia. I cannot, however, refrain from remarking on one of the inferences that might be drawn from the statement of the *Times* correspondent. He would appear to imply that the gold fields of British Columbia afford all prizes and no blanks.

This is, I confess, a somewhat different conclusion from that at which I should myself arrive, after considerable experience in some of the most important gold districts. We generally hear a great deal about the prizes, while little or nothing is said of the blanks; and I certainly entertain considerable doubt as to whether the glowing accounts which from time to time reach this country through the medium of the newspapers are at all times to be relied on. Of one fact, however, I am quite certain, and that is—that I was some years since acquainted with the correspondent of one of our leading journals, who, having taken up his residence in the part of the country in which I was then living, made a large fortune by land speculations, which were in no small degree fostered by means of the articles appearing in that paper.

I would not, of course, impute anything like wilful misrepresentation to the resident correspondent, but it is evidently difficult to take a dispassionate view of facts and circumstances around us when our material interests are deeply involved in favour of a foregone conclusion.

There can, however, no longer be any doubt but that gold-fields of extraordinary richness, and as far as the alluvial washings are concerned, easily worked, exist in almost all parts of the colony, and also that water is plentiful; and I merely throw out these remarks for the benefit of those who, from reading the letters in the *Times*, may be induced to believe that a large fortune is to be made out of mere existence in British Columbia. Let those who go out be determined to get their own living by the exercise of industry and the strength of their own arms, and they may rest assured that an honourable independence may be realised in the colonies with much greater facility and certainty than in any European country.

NEW ZEALAND.—Early in the present year, accounts reached this country of gold discoveries having been made in New Zealand, and although, as far as I am aware, no very detailed reports of the method of its occurence have yet been received, there is every reason to believe that remunerative deposits of the precious metal have been found in this colony. A letter published in the *Daily Telegraph* in March last, states that:—

"The great influx of gold into Dunedin, from the Otago gold-fields, still continues. On the 22nd and 28th of November, and on the 15th of December last, the escorts conveyed respectively 21,000, 15,000, and 14,000 ozs. The total amount of gold brought down by escort, up to the 20th December, is 191,831 ozs., which, at £3 17s. per ounce, is of the value of about £738,550. This is independent of what has arrived here through private hands. New diggings are continually being discovered in the locality."

It also goes on to say that, "It will not be long before New Zealand will be recognised as a gold-bearing country, for it is known that the whole of its mountain ranges are auriferous, from the south to the extreme point of the north."

Also, the *Otago Daily Times*, of the 17th February, has the following remarks on the rapid progress of that settlement, consequent upon the discovery of gold-fields in the immediate vicinity:—"The population of Otago is on the increase, and the gold-fields continue to prove very productive to the number of miners engaged in working them. Every day tends to prove that gold exists in payable quantities over a large portion of the province, and that gold mining will continue to form a profitable pursuit to a large population for many years to come. The most noticeable event during the last month has been the discovery of a new gold-field on the Lammerlaw Creek, near its junction with the Waipori. Opinions respecting it are more or less conflicting, but the general belief is that it will prove a valuable addition to the already opened gold-fields."

I am not in possesion, however, of any special information relative to this colony, and shall consequently pass on to notice the gold-fields of Nova Scotia, which I have recently visited, and with which I am, therefore, better acquainted.

NOVA SCOTIA.—The whole of the Atlantic shore of the province of Nova Scotia is bordered, in an unbroken line, by strata of a metamorphic character, and probably of great geological antiquity, frequently broken through by eruptive rocks. These form a coast in some places low and rugged, and in others boldly undulating; their soil is generally rocky and sterile, although there are large tracks well covered with timber, and affording prosperous agricultural settlements. Along the Atlantic shore this district is generally low, gradually rising to a height of some three hundred feet as it advances northward. Its coast line has, according to Dr. Dawson, a general direction of south 68° west, whilst its inland boundary, although presenting some considerable undulations, has a direction of south 80° west. The extreme breadth of this band at Cape Canseau, its northern extremity, is about eight miles, whilst in its extension westward it gradually increases until, at the west branch of St. Mary's River, eighty miles west of Cape Canseau, it is known to be thirty miles wide. In the western counties, its width has not yet been accurately ascertained, but here its entire breadth cannot be far short of fifty miles. Its total length corresponds with that of the peninsula of Nova Scotia.

This band, in which almost the whole of the gold discovered has been found, chiefly consists of thick bands of slate and quartzite highly inclined, and having a general north-east and south-west strike. In different localities these rocks, which probably belong to the Silurian epoch, have been penetrated by masses of granite, and in their vicinity the quartzites and clay slates usually present a highly metamorphosed appearance.

Since the gold discoveries in California and Australia have been generally known, and public attention has been directed to the conditions under which the deposits of the precious metal usually occur, reports of similar discoveries have from time to time locally arisen in different parts of Nova Scotia. In every instance, however, either mica or iron pyrites would appear to have been mistaken for gold. Some years since, also, a considerable amount of excitement was caused by an article in *Blackwood's Magazine*, in which it was affirmed that gold would be found in the hills to the south of Annapolis, and comparisons were instituted between that locality and the Valley of the Sacramento. Many persons were induced, by this article, to leave their ordinary occupations to seek for gold, but their researches in all cases having proved unsuccessful, the fever gradually subsided, and the subject was ultimately forgotten. It is also worthy of remark that Dr. Dawson, so long ago as 1855, when describing the great metamorphic band, observes:—"Quartz veins occur abundantly in many parts of this district, and it would not be wonderful if some of them should be found to be auriferous."

There is, nevertheless, no authentic evidence of the discovery of the precious metal in the province previous to 1860, when some hundreds of persons, tempted by rumours of gold having been found commenced exploring near the head waters of the Tangier River. The amount of gold obtained in this locality was, however, so small, that the miners ultimately became discouraged, and the excitement gradually subsided. In the month of March, last year, a man who was stooping to drink at a brook, observed a piece of gold among the pebbles at the bottom, and having picked it up searched and found more. This took place about a mile to the east of the Tangier River.

From this date attention became directed to the locality, numerous claims were taken up, and considerable quantities of gold were obtained by breaking the quartz with hammers, and washing the resulting dust in tin pans.

In June, the discovery of gold was reported at Lunenberg, at a locality called the "Ovens." The veins at this place, although generally small, are frequently highly auriferous, and appear to cross each other in almost all directions, in a metamorphic shale belonging to the great southern band. On these discoveries being made known, numerous claims were immediately taken up, and various companies formed for working the veins presenting themselves numerously in the cliff.

Shortly after the discovery of the auriferous nature of the quartz veins, it was found that the sands on the beach beneath the headland also contained large quantities of gold; here claims are likewise rapidly staked off and worked by means of cradles, so that the aggregate daily yield, from the several shore operations, soon reached one hundred ounces.

Gold discoveries subsequently followed each other in rapid succession, at Lawrence-town, Dartmouth, and Sheet, and Isaac's Harbours, Sherbrooke, and Laidlaw's farm.

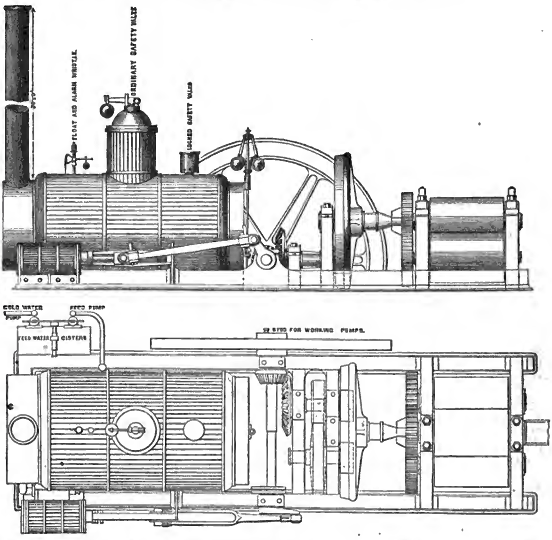
(To be continued in our next.)

THE DISCOVERY OF LONDON FIRES.

MR. FREDERICK HODGES, the eminent distiller of Lambeth, is having a fire observatory of novel construction erected on his premises, by means of which the exact position of a fire may easily be determined, a point of great importance, as the experience of the London Fire Establishment will amply testify; engines frequently having gone considerably out of their way when attracted from the stations by the glare of an extensive conflagration.

The observatory in question has been designed and is being constructed by the engineers to the distillery (Messrs Charles B. King & Co., of 20 Abingdon-street, Westminster). It consists of a wrought-iron mast, having a diameter of 18 inches at the bottom and 12 inches at the top, a gradual taper the whole length; five feet from the top, and at an elevation of 110 feet from the ground, will be erected an ornamental platform stage, to which access will be derived by means of a set of differential pulleys hauling a chain, the chains being worked by the person ascending.

WILSON'S PORTABLE SUGAR MACHINERY.



We have often noticed the proceedings of Mr. Hodges' Volunteer Fire Brigade with a view of recording that gentleman's praiseworthy exertions in the protection of life and property from fire, and in chronicling this last project, we can only commend his example to the careful consideration of fire insurance companies and other private brigades.

We are informed that the handsome fire-engine to be presented to Mr. Hodges by the inhabitants of Lambeth and the metropolis, is now almost completed, the decorations being executed by Signor G. M. Casenlini, of Hercules Buildings, Westminster-road. The presentation will take place on the 20th inst., after which the engine will be placed in the International Exhibition.

WILSON'S PORTABLE SUGAR MACHINERY.

The above engravings represent a novel combination of machinery for crushing sugar cane. It is mounted on an iron foundation plate of great strength. The steam engine is of the usual horizontal construction, fitted with a fly-wheel, which is placed low down to prevent vibration as much as possible. The mill consists of three rollers fitted with wrought-iron side frames; arrangements are provided for adjusting the rolls to any thickness of cane. The fire is fed at the smoke box end of the boiler, thus compelling the products of combustion to return to the chimney. By this means the whole of the heat is transmitted to the tubes. This mill is introduced to the public by Messrs. Wilson & Co., colonial engineers, 14 Cannon Street, London, who have placed one in the International Exhibition—(Class 8, machinery at work.)

CHEMISTRY AT THE INTERNATIONAL EXHIBITION.

The display of chemicals at this year's International Exhibition is the finest that has yet been collected together. Not only are the exhibitors more numerous than in 1851, but there are more first-class names on the list, hardly one manufacturer of eminence being absent. In our leading branches of chemical manufactures the show is wonderfully good, great pains having been taken by the Committees and the Superintendent of the Class to procure their adequate representation. The specimens of alkalies, alum, and the coal-tar dyes generally, constitute the great bulk of the exhibition. Looking hastily through the range of cases, we meet the familiar names of Ailhnsen and Co., Chance Brothers, the Jarrow Chemical Company, Hntchinson and Earl, Muspratt, the Walker Alkali Company, Gaskell, Deacon, and Co., and several others equally famous in the manufacture of alkali. The samples sent by these firms are fine in the extreme, some of the soda crystals being almost perfect in form. When all are so good it would be invidious to choose; but the samples of mono and bicarbonate contributed by Hntchinson and Earl, and Gaskell, Deacon, and Co., appear to be as near perfection as they possibly can be. Mr. Peter Spence has sent a splendid cone of alum, weighing nearly five tons. A hole has been cut in the side in order to render the interior visible. Another cone of equal size and excellence has been contributed by the Metropolitan Alum Company, and forms a most prominent object in the trophy, which has been arranged by Mr. S. Howard, the Chairman of the Metropolitan Committee, and Mr. C. W. Quin, the talented and energetic Superintendent of the Class. A very fine but small crystal of alum, sent by Bray and Thompson, has already attracted great notice. In coal-tar dyes, Messrs. Perkin are of course foremost. Their collection illustrative of the manufacture of mauve is very complete. They are almost eclipsed in colour, although not in excellence, by Simpson, Maule, and Nicholson, who exhibit a magnificent crown of crystallised acetate of rosaniline, which presents the most dazzling appearance, and will soon rank amongst the lions of the Exhibition. In their wake follow Roberts, Dale, and Co. (who also exhibit some fine samples of oxalic acid prepared from saw-dust), Rumney, Holliday, Dawson, Judson, Allen, and several others. Indigo and the lichen dyes are also well represented, the collections of Haworth and Brook, Pincoff, Wood and Bedford, Marshall and Sons, B. Smith and Son, and Haas, being especially good. The collection of specimens illustrating the improvements made in dyeing and calico-printing since 1851, formed by Mr. R. Rnmney at the request of Her Majesty's Commissioners, affords a wonderful proof of the activity displayed in this branch of Chemical manufactures during the last eleven years. It includes the very fine collection of madder products formed by Dr. Schnnck, and exhibited by him before the British Association at Manchester last year. Other chemical manufactures are well shown; some sulphate of copper in gigantic crystals, by Buck and Co., of Manchester; a sulphate of iron crown, by Buckley's trustees; excellent specimens of prussiates, by the Hurlet and Campric Alum Company; bichromate, by White and Co.; and prussiates, by Bramwell and Co.,—are extremely fine. In fine and rare chemicals, Huskisson's iodides, Morson's lithia and nickel salts, Foot and Co.'s acids, the iodine products by Ward and Co., and a series of interesting products by Hopkin and Williams, are only a few of the fine displays in this branch. Dr. Stenhouse, Dr. Muller, and Mr. Church contribute interesting products chiefly discovered by themselves, the specimens of orceine and nitrotheine in the collection of Dr. Stenhouse being wonderfully pure and perfect. Mr. Crookes exhibits the new element, thallium, and several of its compounds. A series of bile products, by Bullock and Reynolds, are likewise very fine. Chemical colours and pigments receive adequate representation at the hands of Winsor and Newton, who sent over £1,000 worth of real ultramarine; J. W. Smith, whose Magenta lake is extremely beautiful, and a number of others. Bailey exhibits some very fine porcelain colours, and Emery and Co.'s case of specimens of these materials is a perfect gem in the taste shown in its arrangement. Wilkinson and Heyward, Mander Brothers, Wallis Brothers, and Rea, send some fine samples of gums and varnishes. Lucifer matches are well represented by five or six of the first houses in the trade; and the familiar names of Everett, Day and Martin, and several others, are here in all their sable glories. Laundry starch is contributed by nine or ten well-known houses, amongst whom may be mentioned Orlando Jones and Co., J. and J. Colman, S. Berger and Co., Broomhall, Wotherspoon, Rickett, Stiff and Fry, and many more. One of the great features in the class is the splendid collection of drugs formed by the Pharmaceutical Society, which fills one of the finest cases in the whole building. This case is really a model in its way in point of convenience and good taste, and does the greatest possible credit to the Society and its architect. Arrangements have been made by which any person can examine, feel, taste, and smell any of the drugs contained in the collection. Hanbury and Co. exhibit some very fine pharmaceutical preparations, which Ransom, Watts, Bastick, Dickinson, Holland, Usher, and a host of others, try their very utmost to beat. The series of cinchona products by Howard and Sons, could hardly have been produced by any other house. A magnificent mass of crystals of codeine, measuring eighteen or twenty inches in diameter, and worth upwards of £200, is exhibited by Macfarlan and Co., who also contribute some splendid specimens of narcotine, morphia and its salts, sulphate of berberine, narceine, and other opium products. The trophy—which consists of a fine mass of alum crystals, surmounted and surrounded by crystals of prussiate, bichromate, sulphate of copper, and other chemicals, piled in artistic forms—was an impromptu affair resulting from a private conversation between Mr. S. Howard and Mr. C. W. Quin, assisted by a sheet of blotting-paper and some very bad pens. The idea gradually grew until it has assumed its present shape. When completed, it promises to be a very magnificent mass of colour and form, and will attract a great deal of admiration even from the ignorant sightseers, who believe all chemicals to be acids, and all acids to be spontaneously explosive.—*The Chemical News.*

The *Washington Star*, April 23rd, says:—"From the refugees that reached here this morning we learn that the Merrimac is being plated three feet lower (under water), and sunk in the water a foot deeper than before. We also learn that the rebel plan is to board the Monitor with twenty men armed with mallets and wedges, pre-arranged to spike her turret port-holes in an instant. This was expected, and I am happy to be able to say, has been thoroughly guarded against by changes made in the Monitor's means of defence."

WARD'S SYSTEM OF OCEAN MARINE TELEGRAPH.

In the United States department of the International Exhibition, may be seen Ward's ingenious system of Marine Telegraph, which consists of flags for day, and lights at night. The flags are composed of three colours that embrace strong contrasts with each other, the horizon, clouds, and sails. *Blue* and *white* (as colours) are excluded, in consequence of their indistinctness when displayed in a clear horizon, or in front of clouds or sails respectively. These flags are twenty-seven in number, and furnish a representative for each letter of the alphabet, including the character, &c., likewise the numerals, by hoisting one of their number as indicatives. Their division of colour is such as to make them distinguishable at any seen distance, whether the flags are extended by the breeze, or drooping in a calm, and applicable to any code-book in use, of whatever language, government, or nation, or useful in themselves without the aid of any code.

The lights for night are more efficient, and of greater range by night than the flags are by day. The lights' telegraphic arrangement is complete for holding continuous communications of any length, on any subject, over a sea range for miles around, with equal correctness and facility as by the electric on land, and practical for despatching the international news between Europe and America, to and from the mail steamers while passing Cape Race Lighthouse, and, like the flags, are applicable to any code, or practical purpose.

These lanterns are used without their telegraphic gear for making secret, or one-hoist signals, by connecting them with distant lines, whereby *four* distinct signals are made with two lanterns, *twenty-four* with three, and *sixty-four* with four lanterns, making *ninety-two* separate signals effected with four lanterns (the telegraphic set) displayed in a vertical line, as when telegraphing, and in like manner, visible at all points of the horizon. By using another lantern one hundred and sixty additional changes can be effected, and by adding a sixth the number may be again increased by three hundred and eighty-four, making the aggregate six hundred and thirty-six separate distinct signals, each one of which may be displayed from any desirable part of the ship, with all sail set, where it may remain for hours unchanged, or till answered, thereby ensuring a certainty of its being observed and understood. The signals are positive, which is not the case with changing or flash lights.

A 1,000-POUNDER CANNON.

On the 17th of April, 1861, Capt. Rodman made the following report to the War Department of the United States:—

The entire success which has attended the manufacture and trial of the 15-inch gun, leaves no doubt of our ability to make reliable guns of even greater diameter of bore than 20 inches, and to manœuvre and load with facility, and without the use of machinery, guns of that caliber. A 20-inch gun, one caliber thick, 210-inch length of bore, and 20 feet total length, would weigh about 100,000lbs. A solid sphere of iron, 20 inches diameter, would weigh about 1,000lbs. A shell, 20 inches exterior diameter, 6·66 inches thick, would weigh about 925lbs. The ordinary service shell need not be over 3·5 inches thick; would weigh about 725lbs., and contain about 38lbs. of powder, making the total weight of the loaded shell about 763lbs. Shells only three inches thick may be fired without danger of breaking in the gun; they would weigh about 657lbs. each, and contain about 48lbs. of powder, giving the weight of the loaded shell about 705lbs. Adopting the same method of loading as for the 15-inch gun, nine men, four at each end of the handspike, would load this gun with nearly the same facility that five did the 15-inch gun; and seven men could load it. The charge of powder to impart the ordinary velocity to one of these shells would be about 100lbs. The living force of the service shell would equal that of six 10-inch solid shot, and that of the battering shell would considerably exceed that of seven 10-inch solid shot; and the destructive effect of such shells, compared with 10-inch shot, upon iron-clad ships and floating batteries, would be in a much higher ratio; their whole crushing force being brought to bear upon a single point at the same time, while that of the smaller shot would be unavoidably dispersed, as regards both time and point of impact. While, therefore, fully recognizing the principle that the destructive effects of projectiles upon a strongly resisting object, increases in a higher ratio than as their calibers, and having no doubt that reliable guns of larger caliber may be readily made, yet, from the fact that 20 inches is about the largest caliber that can be readily loaded and manœuvred, without resort to machinery, and because it is not deemed probable that any naval structure, proof against that caliber, will soon if ever be built, I propose 20 inches as the caliber next to be tested.

A NEW SYSTEM OF ARTILLERY.

On the 9th inst. General Vandenburgh, of New York, who has been engaged for some time in this country with experiments in gunnery, made public the results in a lecture before the Royal United Service Institution.

This result is a new system of artillery, by which a group or cluster of shot are projected, with the highest attainable range and precision to each, the group being such as to sweep and cover the largest area of space with the destroying force.

He exhibited the parts of two guns, one projecting 91. 2oz. shot, the other 85 of the regulation weight of 530 grains each.

The guns are similar in form, of no greater weight, and discharged in the same manner, and with the same facility and rapidity as any single shotted breech-loading gun projecting the same weight of metal.

One is a 12-pounder and one a 6-pounder; each is composed of a cluster of tubes or gun barrels, corresponding to the number of shot.

It was demonstrated that less weight of metal was required in one or two hundred tubes, or bores, for projecting a given weight of matter, when subdivided into so many small shot, than in one tube or bore, for projecting this matter in one shot. He also referred to experiments, showing that each of these small shot can attain as great accuracy at long range as the larger mass.

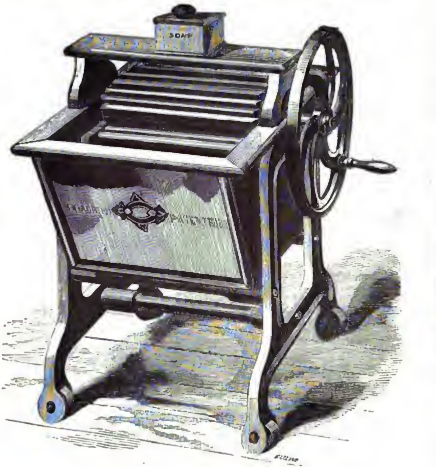
The union of these tubes, in a hollow cylinder, or outer case, so as to assume the same general form as ordinary artillery, without impairing the independent capacity of each to do its duty, was also explained.

One hundred and sixty-three of the Enfield gauge tubes, for projecting two oz. solid shot or shell each, making a twenty-pounder gun, are less than one foot in diameter; while 365 of the "small bore" make a gun of no greater dimensions. The breech is extremely simple, each tube or bore has its separate charge-chamber, the whole in one block or piece. A powder charger (a small brass case) instantly drops a measured charge of powder into each at the same instant, and a cluster of shot corresponding to these chambers are placed in them with the same ease and facility as if there was but one shot. The ignition is from a common centre, from which the fire is radiated to all the chambers. The group of shot diverge slightly on leaving the muzzle. If the barrels are arranged parallel to each other the mechanical defects give a good cluster for extreme range, and will disperse the shot something over 100 feet at a mile. If greater divergence is required, the muzzles are slightly separated or set divergent.

The system was regarded with much interest by the military and naval gentlemen who constitute the Royal United Service Institution.

The proceedings are to be published by the institution, and the members were invited to witness experimental firing of solid shot or shell from these two guns, after which one of them is to be sent to the United States.

BRADFORD'S "E. E." EXCENTRIC ECLIPSE WASHING MACHINE.



This machine, patented by Thomas Bradford, of Fleet-street, London, and Manchester, differs entirely in principle from anything previously introduced for either domestic washing or manufacturing purposes.

The tub or washing vessel is a fixture, in which are placed, suspended by a strong elastic, a series of rollers working loosely in sockets, above these (its ends bearing in the frame-work) is the upper or rubbing roller, two thirds of the circumference of which is covered with Indian-rubber or wooden ribs. Motion is given to this by the fly-wheel; the clothes to be cleaned are placed upon the elastic rollers which readily adjust themselves to the thickness of material to be acted upon, and by turning the excentric roller, the clothes receive a gentle rubbing friction. They may be passed through continually from end to end, or by oscillating the roller, soiled parts may be specially acted upon at the will of the operator, an advantage not possessed by any previous machine. Immediately over the beater is a convenient box to contain liquid soap, which may be run through at will upon any special part of the clothes.

To the machines for steam power a simple and novel patent "worm strap guide" is fixed, by which a reverse motion is easily given to the rubbing roller.

The manipulation of the hand or the "dip and rub of the washerwoman" seem most thoroughly imitated, and the range of sizes in which the machines can be made render its adaptation unlimited.

Mr. Horace P. Tuttle, of the Harvard College Observatory, has discovered a new planet near the star Beta Virginis. It is about a year ago that he discovered the little planet Maia at the institution, and, we believe, in the same constellation.

DUBALLE'S APPARATUS FOR THE ESCAPEMENT OF WATER FROM, AND THE LUBRICATION OF, STEAM ENGINES.

The apparatus represented above is for allowing water to escape from steam cylinders, it is composed of a tube, screwed on to the cylinder, opening through another tube into a spherical or other suitably-shaped chamber, in the bottom of which is a valve, in the form of a plunger, kept in position to allow of the outlet of water by a spring; the top of the valve is in the form of a cup, in which the tube communicating with the cylinder dips.

FIG. 1.

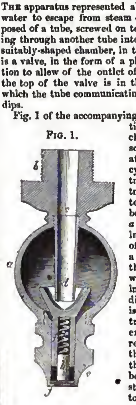


Fig. 1 of the accompanying engravings is a vertical section; *a* is the chamber, made with a screw *b* at top for attaching it to a steam cylinder; *c* is an aperture into which the tube *d* is screwed, extending to near the bottom of the chamber *a*; *e* is a stopper screwing into the bottom of the chamber; *f* is a valve in the stopper, the upper end of which is capped, and into which the tube *d* dips. The valve rod is made, by preference, triangular, so that except when the cup rests, or is pressed by the steam on its seat, there are passages between it and the stopper *e* leading to the atmosphere; *i* is a spring in the valve *f* connected to a rod *i* which latter is connected to a cross bar supported by a flange *j* formed on the lower part of the stopper *e*. An apparatus of this description is, by preference, placed at each end of the cylinder, in order that water may be effectually withdrawn from both sides of the piston. The action is as follows:—The valve *f* is open until the admission of steam on one side or other of the piston, as the case may be, issuing through the tube *d* and pressing on the cup, closes the valve and keeps it closed until the commencement of the return stroke, when any water which may have become condensed escapes, and so on.

FIG. 2.

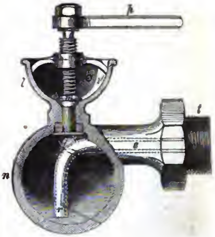
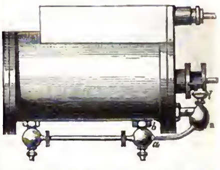


FIG. 3.

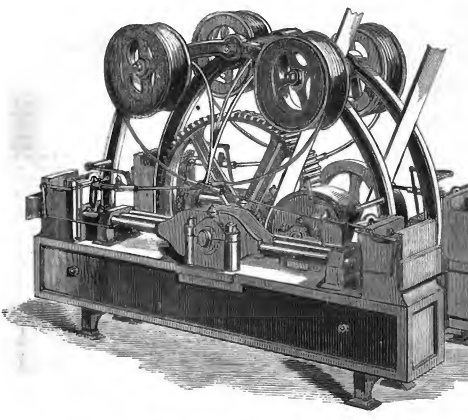


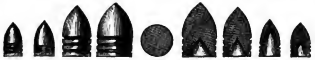
The apparatus for admitting lubricating matter consists of a cup closed at bottom by a screw valve, and communicating, when the valve is opened, with a chamber into which two tubes lead from the cylinder; one of these tubes, curved upwards, is of larger bore than the other, which is curved downwards, and nearly touches the bottom of the chamber.

Fig. 2 is a sectional elevation of this apparatus, and Fig. 3 shows both apparatuses fitted to a steam cylinder; *l* is the cup with the valve *m* at bottom; *n* is the chamber. The valve is kept closed by a screw *o* turned by a key *p*; *q*, *r*, are tubes in the chamber; the tube *q* is about twice the diameter of the tube *r*; *s* is a lateral continuation of the chamber, which terminates in the screw *t*, by which it is connected to the cylinder. The working is as follows:—The cup *l* is filled with oil and the screw valve *m* opened, which allows of the contents entering the chamber; the valve *m* is then screwed down. On steam being admitted above the piston a portion enters the chamber by the tube *q*, and pressing upon the oil forces it through the smaller bored tube *r* into the cylinder.

The gallery devoted to the fine arts at the Exhibition affords work for at least a week, so varied and beautiful are its contents. Dust, however, prevents the visitor from enjoying the intellectual treat. The pictures are covered by it, and the atmosphere, charged with the same material, is as injurious to the lungs as are the particles of stone and steel inhaled in the workshop of a needle grinder.

WARD'S IMPROVED BULLET-MAKING MACHINE.





IMPROVED BULLET-MAKING MACHINE.

The machine illustrated above has been introduced into this country by Mr. W. H. Ward, New York; it is intended for making elongated bullets of any shape, as represented in the lower figures.

The frame consists of two hollow-square sides, connected by end and feet cross-pieces, between which is the gear-wheel, driving-pinion, fly and compound band-wheel, and on each sidepiece is an arch for suspending the reels that contain lead-wire.

The main shaft passes across the entire machine with two bearings on either side, between which are three cams that propel the punch and wedge bars, which are guided by fixed cross-pieces.

The wedges are three inches deep, and one tenth taper in four inches where their power is applied in the head-blocks for securing the dies during the formation of a bullet.

The lead-wire is supplied from the reels by a self-adjusting feed, carried back by the retrograde movement of the punch-bar, to feed forward on its return (movement) by the aid of a spiral spring keeping the feed-tube-lever against the set pin that forced it back, until the lead-wire comes in contact with an adjustable stop in the jaws of the vertical compressing forceps, which are then rigidly closed, and the horizontal cutting forceps brought into requisition, severing the lead-wire, while under transverse compression. Then, by the retrograde movement of the punch-bar, the vertical forceps are opened and the severed piece drops into a receiver in front the dies, and is forced by the punch-bar on its forward movement into the dies and forms a bullet, when a retrograde movement is given to the wedge-bars to separate the dies, leaving the newly formed bullet on the point of the punch, which releases itself, by its base coming in contact with the blank receiver on the retrograde movement of the punch.

The lead-wire from which the bullets are made, is caused to pass through packed oil tubes for lubricating its surface before cut in pieces.

ON THE PRACTICAL LIMITS TO ECONOMY FROM THE EXPANSIVE USE OF STEAM.

From the *Journal of the Franklin Institute.*

The laws which govern the action of steam in the production of power indicate a large economy from its use when allowed to expand after communication with the boiler has been closed. Experience has, within certain limits, seemed to verify this indication, and the economy due to expansion has become almost a dogma in engineering.

Within a very few years some have been found bold enough to question the value of this generally received opinion, and have instituted experiments for the purpose of demonstrating its truth or falsity. It is not easy to make *reliable* experiments on this subject upon such a scale as would, in practice, entitle their results to credit.

It *is easy* to try experiments apparently conducted with care on any given engine, observing the effect of different rates of expansion, which, however correctly observed or noted, are utterly valueless in determining the true point at issue. For from the nature of the case, they having been tried on the *same* engine, with the *same* load, the conditions of a true comparison have not been fulfilled, viz., that the conditions be the same. It is evident that in such a case, varying the rate of expansion, involves for the maintenance of uniform power (*mean* pressure) a change of initial pressure. A mean pressure, for example, of 20 pounds, requires, when working at full stroke, 20 pounds initial pressure; when cutting off at one-third stroke it requires 28½ pounds, or more than forty-two per cent. more, &c.

Consequently, it is seen that in the case described, which is almost the only kind ever tried having this object, *two* changes are made, first, a change in the rate of expansion; secondly, a change in boiler or initial pressure. Nor can the difficulty be overcome by throttling. There is a certain loss from condensation when steam is expanded, whether the expansion takes place at the throttle or the cut-off valve. If, then, steam be generated of the pressure required for the high rate of expansion, it ought to be *used* at that pressure with the low rate of expansion. It needs no argument to show that this is simply impossible when the same engine is used to drive the same load.

Apart from the varying degree of economy with which steam of different pressures can be generated, a change of maximum boiler pressure affects the loss by radiation and leakage, and, more important still, the question of cost, size, and weight of the machinery required. If a boiler is to be constructed for a working pressure of twenty pounds per square inch, if an engine is to be designed for such pressure, the cost and weight of both will be less than if thirty pounds is to be the limit.

Now these conditions of size, cost, and weight are precisely those most important in a practical point of view, next to economy, but are apt to be left out of the question by the theorist.

The true practical question at issue is simply this:—*Given*, a standard maximum steam pressure, and a standard maximum resistance, at what rate of expansion shall the steam be used to produce the best and most economical results, all things considered?

By "all things" I mean, principally, economy of first cost, of wear and tear, of fuel, space, and weight. Stated in more concise terms it stands thus: Are large or small cylinders best for the development of power economically?

The solution of the question depends on considerations partly theoretical, partly practical; while they may be enumerated in terms sufficiently concise, their value and true bearing can be ascertained only by properly conducted experiments.

Some of the causes which may operate in favour of using smaller cylinders, or a lower rate of expansion, are as follows:—

1. The condensation of steam due to, and inseparable from, its expansion when communication is cut off from the water from which it has been generated; the amount of loss from which is greater, the further the expansion is carried.

2. The heat taken from the steam to evaporate, at continually reduced pressure consequent on expansion, the water previously condensed from it; the amount of which loss increases as the rate of expansion is raised.

3. The loss of heat from radiation, externally and internally, from the surfaces of the cylinder and heads; it being greater as the size of the cylinder is increased.

4. The amount of steam lost in filling the ports

and clearances of the cylinder, which, although producing a small dynamic effect, increasing with the waste of expansion, is, nevertheless, a positive loss, greater in ratio of the size of cylinder.

5. The tension of vapour on the exhaust side of the piston, or back pressure, a constant resistance for any rate of expansion, necessarily increases in amount, the greater the size of cylinder.

6. The pressure required to overcome the resistance of the engine alone, doing no work, simply overcoming the friction, working the pumps, &c., and maintaining the velocity; which is ordinarily from 1½ to 2½ pounds per square inch in a well-proportioned engine, and is, of course, in proportion to its size or that of its cylinder.

7. Cost, space, and weight increase in proportion to size of cylinder, as also does the expense of wear, of oil, of renewal, &c.

In favour of the larger cylinder, rendered necessary to obtain the supposed benefit from expansion, it has been urged that the surplus pressure exerted before steam is cut off, acts beneficially in overcoming the inertia of the moving parts of the engine. This argument appears to me fallacious. In a well designed engine (intended to rotate a shaft for giving off its power) the reciprocating parts should combine as *little weight* as possible with the requisite strength and rigidity; by which the inertia and momentum are reduced to a minimum, and are overcome by that of the mass in rotation. Such an engine, when at work, is supposed to be moving at uniform speed. Its revolving parts have, therefore, no inertia to overcome due to change in direction of motion, and that of the reciprocating parts at each change of direction, if properly designed, is comparatively so little, that it does not affect the speed perceptibly. So far from being a benefit, a surplus pressure at the beginning of each stroke, and a deficient pressure at the end of it, are positively injurious, and will infallibly tell upon the working of the engine, and in its bills for repairs, if carried to an extreme.

With engines which do not communicate their power through a shaft, but which, like the Cornish engine, either operate directly on the resistance or upon a mass, which in its turn overcomes the resistance, in either case starting each stroke from a state of rest, the whole aspect of the case is changed. Here an excessive impulse is required in starting the load to overcome suddenly its inertia. The great power thus stored up is not expended until long after it has ceased to impel the mass, which finally, when its momentum is expended, stops. In this case a large cylinder is necessary; and, as a consequence, a high rate of expansion. But the great economy of this class of engines is mostly due, not to expansive working but to the peculiar application of the power. At least, because a large cylinder and high expansion may apparently produce benefit in this case, we have no right to anticipate equally good results from the same things applied under different practical conditions.

It has been before stated that the value or effect of the various causes, tending to modify the theoretical gain from expansive working, could be determined only by properly conducted experiments; and that the experiments generally tried with this object in view were not so conducted.

To fill this want of the profession, a Board of Naval Engineers of the United States, made by authority in November, 1860, on the steamer Michigan, a series of experiments, which for care and elaboration are not surpassed, if equalled, by any others recorded of a similar nature.

The conclusions of the board, and their method of conducting the experiments, have been the subject of controversy in this Journal. It is not my purpose to enter into a discussion upon, or to defend, the course pursued by the board. Each reader of their report who approaches it with an impartial spirit and a desire to attain a true understanding of so important a subject, will probably form his own conclusions.

After a very careful study of it, I am satisfied that some misconceptions exist on the subject, and that, rightly construed, their suggestions are entitled to grave consideration.

The method adopted in making their investigation was to vary the load in such a manner as to maintain, with the same boiler pressure, the same *mean* pressure with different rates of expansion. This proceeding was equivalent to varying the size of cylinder, the boiler pressure and load remaining the same.

The method adopted in comparing results was to adopt, as a standard of power developed, the amount of water pumped into the boilers, thus eliminating everything appertaining to quality of coal, methods of firing, relative amount of boiler and grate surface, &c., the weak points in comparisons where great accuracy is required.

It does not appear that in any respect the care and attention requisite in such researches were wanting. The tank was placed in such a position as to prevent the possibility of unknown leakage; and each trial extended uninterruptedly over 72 hours. The machinery was of size sufficient to make the results valuable practically, and, it is probable, was in better condition generally than marine machinery ordinarily is when in service.

The boiler pressure was kept throughout the trials at 20 pounds above the atmosphere, or 34·7 pounds total. The "back" or condenser pressure averaged 2·7 pounds (an unusually low figure, it being generally at least one pound higher—the difference being in favour of high expansion).

(*To be concluded in our next.*)

MEETINGS FOR THE WEEK.

MON.—*British Architects*, at 8 p.m.
  United Service Inst., "The Character of Gun Best Adapted for Naval Warfare," by Captain E. G. Fishbourne, R.N., at 3 p.m.

TUES.—*Inst. Civil Engineers*, Continuation of Paper "On the Malta and Alexandria Cable," by H. C. Forde, Esq. II. "On the Electrical Tests employed during the Construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables," by C. W. Siemens, Esq., at 8 p.m.
  Royal Inst., "On Ancient Art," by C. T. Newton, Esq., at 4 p.m.

WED.—*Society of Arts*, "On the Republic of Liberia, its Products and Resources," by Gerald Ralston, Consul-General for Liberia.
  Geological, I. "On some Metamorphic Rocks in Banffshire and in East Sutherlandshire," by Prof. R. Harkness, F.R.S., F.G.S. II. "On the Geology of the Gold-fields of Nova Scotia," by the Rev. D. Honeyman, communicated by the President. III. "On some Fossil Crustacea from the Lower Coal-measures of Nova Scotia; on *Eurypterus*; and on some Tracks of Crustacea in the Lower Silurian Rocks," by J. W. Salter, Esq., F.G.S., at 8 p.m.
  Architectural Association, Fourth *Conversazione*, at 8 p.m.

THUR.—*Royal Inst.*, "On Progress of the Chemical Arts," by Dr. Lyon Playfair, at 3 p.m.
  Antiquaries, at 8.30 p.m.
  Royal Soc., at 8.30 p.m.
  Civil and Mechanical Engineers, "On Steam Boiler Explosions," by C. B. King, Esq., at 7.30 p.m.

FRI.—*Royal Inst.*, "On Coal as one of the Great Materials of British Industry," by Warrington W. Smyth, Esq., at 8 p.m.
  United Service Inst., at 3 p.m.

SAT.—*Royal Inst.*, "On Agricultural Chemistry," by Prof. Anderson, at 3 p.m.
  Linnean, Anniversary, at 3 p.m.

A NEW SUBMARINE BATTERY.—The Boston *Journal* of Wednesday reports that an iron gunboat with a submarine battery is to be built at East Boston. It learns that the Government has contracted with certain parties in this city to build an iron gunboat of between 600 and 700 tons, to be furnished with Woodbury's Submarine Battery. The vessel will be 136 feet long and 30 feet beam, and will be built of iron in the most substantial manner. She will carry one gun on deck, and a large gun for submarine firing through the bow of the vessel. She is to be built at the Atlantic Works, East Boston, and is to be done ready for service in from four to five months. The experiment of firing under water was successfully tested at Simpson's dock at East Boston on Wednesday.—*Boston Commercial Bulletin, April 19th.*

CONISBEE'S TWO-COLOUR PRINTING MACHINE.

WE have lately seen a circular printed in two colours at one operation, by a machine recently patented by Mr. W. Conisbee, of the Waterloo-road. The machine, which we illustrate on next page, is of the same construction as the "Main," with the addition of some simple mechanism to enable it to print two or more colours at the same time. It has one cylinder only, two type surfaces, and two inking apparatuses; each sheet to be printed requires but one feeding, the sheet being held in the machine until the requisite number of colours are printed. Two boys are enabled to execute the same quantity of work as four boys with the ordinary single colour machine. This machine will be found exceedingly handy for cross rule work with coloured headings. We understand that a double royal machine has been in successful operation for some months at Messrs. Waterlow and Sons', London-wall.

TO CORRESPONDENTS.

Received.—"A Man of Science,"—why did not J. A. D. put his own name to the letter?—R. M., Capt. H., G. W., G. P. G., J. H. G., Pen, Capt. L., R. M. M., G. C., E. C. P., W. W., H. and T., S. and Co.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

ATLANTIC TELEGRAPHY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your correspondent, "Short Circuit," says that the Atlantic cable "broke down because they tried to work through *so long* a circuit *too fast*, employing too great a battery power *for the purpose*." But in this announcement "the wish" is evidently "father to the thought;" for he adduces no evidence in its support. The truths which subsequent investigation for the most part has brought to light show the following to have been the reasons for the want of success:—

1st. The Atlantic Company were the adventurous pioneers in a vast, but obscure, and, till then, untried work.

2nd. The cable's conductor was devised on false principles, the theory on which it was constructed being that a small conductor would work more rapidly than a large one.

3rd. One-half of the cable was made at Greenwich and the remainder at Birkenhead—200 miles apart; and the entire cable was never worked through till it was shipped and ready to sail.

4th. The cable—2,500 miles in length—was not begun till February, 1857, and was shipped and ready to start in July of the same year—the whole business having been most precipitately executed, to satisfy conditions imposed upon the directors by the provisional committee.

5th. After the failure in 1857, the cable was unshipped, and coiled in tanks at Plymouth; then uncoiled, and reshipped, in 1858, at great hazard of injury.

6th. It is now proved that the cable was actually damaged at the very time it started from Plymouth in 1858, and that it was submerged in that state, after having been subjected to fearful storms in the Atlantic.

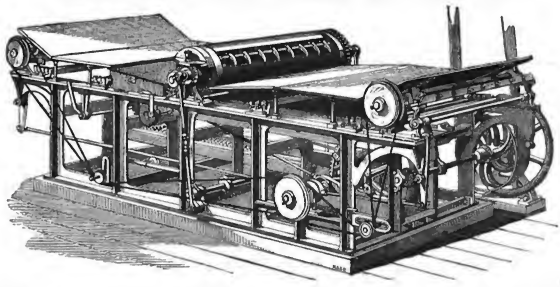
7th. Enormous and unnecessary currents of coil and battery electricity were forced into it, for the purpose—not, as "Short Circuit" would have it, of working *faster*, but of *working through the faults*, in which they succeeded for a time; but, as experience has since shown in other cables, if they had acted exactly contrary, using very moderate and properly-arranged currents, the cable might have worked, even though imperfectly, at this very time.

These are the true causes of the cessation of the Atlantic cable; and there is now not the slightest physical or scientific difficulty to prevent a cable—constructed in accordance with the sad experience above referred to—from being laid between Newfoundland and Ireland successfully and permanently, and worked at the rate of from 12 to 16 words per minute, daily and regularly.

"Short Circuit" gives us his opinion, "*as a practical telegraphist*," that all long cables must be destroyed by the battery power requisite to work through them, and says that many other "practical telegraphists" agree with him.

Digitized by Google

CONISBEE'S TWO-COLOUR PRINTING MACHINE.



I am well acquainted with every one who has ever had anything to do with a cable, and know their views upon these subjects, and I certainly could not find a person to endorse his views.

I think, therefore, he is bound, in the interests of science, and in common manliness, to disclose at once his own name and those of his disciples, that we may judge of the value to be set upon his and their opinions; the subject is a vast one, and important to the best interests of humanity, and should not, therefore, be treated in a hole-and-corner spirit, but discussed in the light of day.

"Short Circuit" is quite welcome to be merry over my own opinions as to the length of cables; but I reiterate that between 3,000 and 4,000 miles of cable would be required to connect Falmouth and Halifax, and if the law of squares be true (which I do not believe), and not subject to enormous modification by surrounding circumstances, it would be impossible to work it unless it were made in a manner so costly as to preclude any prudent man from recommending such a route.

The offer of Messrs. Glass, as I have been informed by one of the firm, was to lay a cable for the Government from Ireland to Newfoundland, not from Falmouth to Halifax.

I still say, therefore, that our line of 2,000 miles is much preferable; and, finally, in answer to "Short Circuit's" question—"What does Mr. Saward say to a line with sections of 700 miles, such as on the Northern route?" I say, first, that there is one section on that line that will require not 700, but, at least, 920 miles of cable; and having set this right, I say that I should greatly prefer a line that had only a circuit of 920 miles; but the reasons why I do not prefer the Northern line are—

1st. That it is divided into so many circuits each, with shore ends constantly exposed to damage and incapable of being worked by relay with advantage.

2nd. That even on the admission of Sir Leopold McClintock, it has not hitherto been found possible to discover even a feasible landing place in Labrador.

3rd. That it is impracticable on the evidence of Dr. Wallach, who accompanied the northern telegraph expedition, to maintain any cable whatsoever on the western shores of Greenland.

4th. That over Iceland and Labrador, some 600 miles of aerial wires have to be constructed along countries the most inhospitable in the whole world. In Iceland not a single tree of greater proportion than a shrub can exist, and in Labrador daily storms, to which those that every winter blow down miles even of our British Telegraph system in the north are gentle zephyrs, would not allow a week's respite to the communicator.

5th. That even if practicable and possible, the establishment of communication with America by this route, would cost a million and a quarter of money, at the very smallest computation.

And 6th. The key to the whole communication, if it were not impossible to perfect it, would be in the hands of a foreign nation, whereas the Ireland to Newfoundland route is on national soil at both ends, and there is no practical difficulty whatever in its establishment.

As to the line by way of Russia, which "Short Circuit" thinks I ought to have taken into consideration;—when I mention that this "short circuit" is 18,000 miles long, (when finished) and that it is proposed to carry it through the territory of tribes along which Russia has several times attempted without success to march an army, I think I may be excused from so venial a dereliction of duty as the postponement of a decision upon its merits. The strength of my position consists in the fact—not that I am "not disposed to consider any other route than my own"—but that I have deeply studied them all, and arrived at the honest conviction that there is not one fairly practicable, except that from Ireland to Newfoundland. If the gentleman who wrote to you had done the same, he would have spared your columns the heavy infliction of his and my communications, and I should not have had to reply to his learned quotation with another from the same language—"*Ne sutor ultra crepidam.*" Yours truly,

GEORGE SAWARD.

◆

A PROFITABLE DISPOSAL OF ONE OF OUR OLD LINE OF BATTLE SHIPS.

SIR,—Discussions upon our future navy are becoming something more than earnest; but it is not by discussion, in whatever manner conducted, that the matter in dispute can be satisfactorily settled.

With a view to end the conflict of opinions as to vessels, arms, and armour, I would suggest that one of our old line of battle ships should be turned adrift, under sail, in the North Sea, and there operated upon, as would be an enemy's vessel by a *fast* steamer, armed not with cannon, but with a few submarine explosive shells of various sizes and variously charged. I will not go into details how such operation can, with comparatively little expense, be performed; but I would observe there should be no secrecy or mystification in the matter; since I am confident that the arm proposed to be tested, upon a scale worthy of its importance, is, of all now known, the best adapted to the protection of such a maritime state as insular England.

The school of Nelson, which though excellent in its day, does not embrace the instruction of the appliances of chemistry, in the art of war, at the present period; and we must of necessity depart from the course we can no longer with safety pursue.

Yours obediently,

M. HARVEY, Captain R.N.

Cheltenham, 10th May.

◆

POWER OR SPEED FOR THE NAVY.

SIR,—"A Civilian" asks to what "school" do I belong? In answer, I beg to say I am a humble follower in the "George Stephenson" school.

With respect to "speed," your correspondent's explanation goes very far towards removing my objections. I regard his letters as highly valuable and important; and when I point out to him that speed can be obtained without the serious defects which he anticipates, I think he will with me advocate "power *and* speed" for the navy. In preferring a strong midship body, with light extremities, for speed and seaworthiness, I do not lose sight of the necessities o the case. The bulkheads must be as watertight as the ship itself, and well stiffened on the cellular system. The vulnerable portion must be made as unimportant a part of the ship as possible. Its duty is only to divide the water easily, and assist in lifting in a sea. The enemy may riddle it with shot, if they choose to waste it in that manner—it is almost as immaterial as if they aimed all their guns at the bowsprit. No one should be in the vulnerable part, and it should and can be so proportioned that the ship can be fought even if this vulnerable part gets full of water.

I think that wooden bottoms will prove highly dangerous. I know no more of Mr. Reed's plans than what I have gathered from the public prints; but I could, without difficulty, design a vessel which would send them to the bottom with almost as much facility as the Merrimac sunk the Cumberland. I would, therefore, advise that gentleman and the Government to adopt iron entirely. The only advantages derived from adopting wooden bottoms are, first, that they can be coppered, and, therefore, will not foul so quickly as iron—an apparent advantage for distant stations; and, secondly, the possibility of using the large stores of timber possessed by the Government.

By adopting Rennie's floating docks both at home and abroad, the operation of cleaning the bottoms of iron vessels can be readily performed; and there cannot be much difficulty in disposing of the timber stores.

Your very obedient servant,

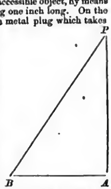
T. MOY.

1 Clifford's-inn, May 12, 1862.

◆

A PLAN FOR ESTIMATING THE DISTANCE OF OBJECTS.

SIR,—I beg to suggest the following plan for estimating the distance of an inaccessible object, by means of an Enfield rifle and a plug one inch long. On the thin end of the ramrod fix a metal plug which takes into the rifle grooves, and through the hole in the other end put a piece of wood a foot long with a pin at each end. Let *A* be the observer, *P* the inaccessible point—rest the rifle on the ground at *A* with the band vertical. Place the plug in the barrel and align the pins with *P*. Then raise the plug until it has been lifted 19½ inches. Put a point *B* 200 yards off and aligned with the pins. As the groove makes a complete turn in 78 motions, the angle *P A B* will be a right angle.



Move the rifle to *B*, align the pins with *A*. Mark the height of the ramrod, and then move up the plug in the barrel until the pins are aligned with *P*.

Observe the height of the ramrod. This can easily be done within $\frac{1}{16}$ of an inch. By this means the angle $P B A$ can be ascertained within the eighth part of a degree.

Now, suppose that P is at 1000 yards off, we shall be able (it will be found) to ascertain its distance within 12 yards, which is quite sufficient for all purposes of shooting with light or heavy ordnance.

So far as I know this plan is novel, but at any rate it seems to be a method that will be very useful, and which requires no machinery or instruments beyond a plug an inch in length.

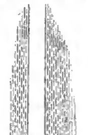
Numerous other applications of the idea have occurred to me, and will doubtless be evident to your readers. Yours truly,

J. Macgregor,
Capt., Musketry Instructor London
Scottish Volunteers.

Temple, 10th May, 1862.

RUDDERS.

Sir,—The question of some better means than the present for steering our large steam ships has become a matter of such vital importance that much attention is at this moment bestowed upon it, both as regards the efficiency of the rudder itself and the power to move it. It is of the latter I would offer a few remarks, in reference to the plan suggested by your correspondent, "Half-pay," and will endeavour to explain why, in my opinion, it would not practically answer.



First hang the ruddor, say 7 feet broad, in the manner proposed; put the helm hard-a-port, or any angle of 30°; there will then be (less half the size of sternpost) 4 feet of rudder on the starboard side, and 3 feet on the opposite side. Now, the water would impinge upon this part with a force equal to the velocity of the ship; but not so on the starboard side, for the reason that the water striking the rudder on the port side has no means of escape otherwise than through the aperture made between the stern-post and rudder, and this it would do with so much force as to turn the course of the water on the opposite side in a line with the face of the rudder, and, consequently, neutralise, in a great measure, its effect.

I am, sir, your most obedient servant,

Practical.

GIFFORD'S INJECTOR.

Sir,—Having often heard "that our engineers could not assign the 'reason why' *it does feed*," and hearing it repeated the other day, it occurred to me while looking at the drawing that it was the following cause which produced the much appreciated effect:—The water being admitted from the supply cistern to fill the space between the *steam jet* and the boiler till it overflows, we have then the *water jet charged*; when the steam is turned on, *it* operates exactly as an explosion of gunpowder does behind a bullet, the water in both jets being the *shot* and the *steam* the *charge* of powder; the *shot of water* being fired against the check valve at the boiler brings to bear on it not only an *equivalent* to the pressure in the boiler, but the *force* of the *matter in motion* contained between the steam jet and boiler, the valve opens, as a consequence, and admits the water. The *continuance* of the cause provides for a continuance of the effect, so that we have not a *succession* of *water* bullets and steam charges, but a stream of shot and explosions.

So much for a solution of this mysterious subject, and if it is not the true one, the publication of it may tend at least to lead the way to what I think ought to be attained, namely, ability to render a reason *in such matters*.

I am, Sir, yours respectfully,

G. P. Grant.

May 14th, 1862.

Gossip.

On Tuesday last the Japanese ambassadors paid a visit of inspection to the Royal Mint. They did not, however, appear to be particularly struck by the money-making marvels of that place, and when a medal, bearing an inscription commemorative of their visit, was imprinted and handed to them, their perfect innocence of any knowledge of the meaning of the compliment was amusing in the extreme. The heaps of sovereigns visible in the stamping roma were objects of some apparent interest; but listlessness, not to say vacuity, seemed the dominant characteristic of the entire party. Japanese money is principally made of a sort of bell metal. The coins—if so they may be called—are thin, oblong castings, perforated by a hole in the centre, and decorated (!) by Japanese inscriptions. Possibly the ambassadors may carry home with them one lesson from England, and it is, that it is desirable to make money, literally speaking, more rapidly than they have hitherto done. Their present mode of coining is as primitive as was that of the monarchs of the Heptarchy, or that of the illicit coiners of the metropolis of to-day. Why not establish a mint at Jeddow Nagasaki?

The gigantic works in connection with the Suez Canal scheme are being pressed forward with a vigour worthy the undertaking. The Egyptian Government have furnished a great number of hands for the service of the company—in fact, nearly 22,000. It must not be imagined, however, that these comparative slaves will exert themselves as would as many English or French labourers. The intention is to employ, indeed, double that number, if they can be got from Egypt. At present, the work is almost exclusively concentrated upon the cutting to be made upon the sand heights of El Djiser, and the engineers promise that what they call the *rigole de service*, or elementary canal, shall within the next two months carry the waters of the Mediterranean into the basin of Lake Timsah. This canal, or cutting, as we should prefer calling it, will be about 15 feet wide, and 18 inches deep. Some twenty dredging machines are to be employed in clearing out a channel, which, completed last year, has realized the prophecy of the late Robert Stephenson, and now become choked by sand. There is no doubt that the company have undertaken a task which it will require all the talent of their engineers and all the muscular force of their 40,000 assistants to accomplish.

Experiments have recently been made at Shoeburyness to show that the iron shield invented by Captain Inglis, Royal Engineers, is sufficiently effective as to resist the shot from the most powerful ordnance yet introduced. This shield is composed of strong wrought-iron planks, crossing each other in alternate layers, and by this means any degree of strength can be obtained for a permanent work of fortification or defence. The shield has been fired at from a range of 200 yards, with 68 and 110 pounders, without the least effect; and it also remained intact after an attack from Sir W. Armstrong's 300-pounder, which threw a shot of 156lb.

We learn from the *Times* that Admiralty orders were on Saturday last transmitted to Deptford dockyard for the immediate commencement of the Enterprise, which is to be proceeded with as rapidly as possible. The keel is in the hands of the shipwrights, and will be laid down in the course of a few days The preparation of the frames will be carried out as fast as the moulds can be issued from the mould-loft. The Enterprise is to be a powerful sloop of war, armed with the heaviest Armstrong guns at present in use—viz., 110-pounders. Her dimensions are to be 180ft. in length, 36ft. in breadth, and 15ft. in draught of water. The timber frames, planking, shelf-piece, and water way of the vessel will be made to serve as "backing" for the armour, which will be equal in resisting power to that of our largest ships. It is a remarkable fact that the offensive power of the new vessel, which will be of about 1,000 tons burden only, is even greater in proportion to her tonnage than that of the Defence and Resistance. The entire superintendence of the Enterprise has been intrusted by the Admiralty to the designer, Mr. E. J. Reed.

Amongst the mechanical marvels of the Exhibition is a machine exhibited by Mr. Peters for microscopic writing, which is infinitely more wonderful than Mr. Whitworth's machine for measuring the millionth of an inch, which excited such astonishment in 1851. With this machine of Mr. Peters', it is stated that the words "Matthew Marshall, Bank of England," can be written in the two-and-a-half millionth of an inch in length, and it is actually said that calculations made on this data show that the whole Bible can be written *twenty-two times* in the space of a square inch.

Some months ago the Brazilian government gave an order for a lifeboat, on the plan of the National Lifeboat Institution, to be built for them in London. Accordingly a single banked lifeboat, 30 feet long and 7 feet wide, has just been finished for them by the Messrs. Forrestt. On Saturday the harbour trial of the boat took place in the Regent's Canal Dock, Limehouse, and passed off satisfactorily. The boat and her transporting carriage, and a full equipment of stores, were sent yesterday by railway to Liverpool, for shipment to Brazil.

As great curiosity is felt respecting the success of this Exhibition as compared with its predecessor of 1851, the following figures may not prove uninteresting. "We find," says the *Daily News*, "that up to the 8th July, 1851, the number of season tickets sold was 25,076, producing £66,491 5s., whilst the number sold up to the 13th May in the present year was 21,461, producing £78,838 4s. Of this sum £8,019 goes to the Horticultural Society, leaving a clear balance of £70,819 4s., being an increase of nearly £5,000 in the receipts of 1862 as compared with those of 1851, and the money having been taken in nearly two months less time. As the interior is fast getting cleared and arranged, it becomes more attractive every day, and therefore it may reasonably be expected that by the 8th July this year, the return will stand exceedingly well in the comparison.

Under the heading of "The Workshops of England," an Illustrated Paper of last week gave a lengthy description of Messrs. Ralph Heaton and Sons' Mint, Birmingham. We should not have ventured to notice the very readable and extensively illustrated article of our contemporary on this subject, if it had not contained one or two statements which require, not contradiction exactly, but explanation. It is said, for example, of the firm in question, that "so extensive are the means at their disposal, that their capabilities at the present time are six times as great as those of the Royal Mint in London, the number of coining presses available for work amounting to forty-eight, which are adequate to the production of two millions of pieces per day." A reader unaware of the facts would naturally imagine that the "forty-eight coining presses" alluded to were placed in the workshops of Messrs. Heaton, whereas the great majority of them—something over thirty—have been erected at the instance of Victor Emmanuel in Italy! Then, again, in a foot note to the article in question, it is stated, in such a way as to induce a belief that the Messrs. Heaton are the contractors, that "the contract" (for British bronze coin) "as originally tendered for was 1,720 tons, but the exact amount cannot be stated until the work is completed, (!) which will occupy the whole of the present, and a considerable portion of next year." Now, Messrs. James Watt and Co., of Soho, near Birmingham, were the actual contractors for the 1,720 tons of bronze coin referred to, and it would have been more ingenuous, though less ingenious perhaps, if the writer of the article in question had said so. Possibly when another contract for bronze coins is to be let, the Messrs. Heaton may be fortunate enough to obtain it. Meanwhile it is as well to "render unto Cæsar the things which are Cæsar's."

The Steam Floating and Land Steam Engines of the Fire Brigade.—On Sunday last several distinguished foreigners, at present in town to visit the Great National Exhibition, paid a visit to the upper and lower steam floating fire-engines lying in the river Thames, as well as the land steam engines built by Messrs. Shand and Mason. Captain Shaw stated that the work done by the four steam engines, viz., the two floats and the two land engines, was as follows:—The lower float worked one hour, during which time it threw 65,400 gallons of water, or 292 tons, at a cost of 5s. for fuel, &c. The upper float worked eight hours, and threw 645,000 gallons, or 2,832 tons of water at a cost of £1 15s. The new land steam engine worked nearly eight hours and forty minutes, and at a cost of £1 threw 446 tons' weight of water. The old land steam engine worked for nine hours and forty minutes, and threw 80,373 gallons of water, or 401 tons, at a cost of 18s. The total quantity of water thrown being 4,021 tons, and the total expense being £3 18s. The expenses, if done by the manual power engines, would have been:—Twenty-six long hand engines, of the size used by the brigade, with seven inch barrels and eight inch stroke, if worked for only nine hours by five reliefs of 728 men each, or three to forty in all, would deliver the same quantity of water at a cost for each engine of £12 14s., being £9 16s. for labour and £3 3s. for refreshments, making in the whole £336 14s. The visitors appeared astonished at the capabilities of the steam apparatus.

The Prevention of Boiler Explosions.—A correspondent writes to the *Manchester Guardian*:—"The dreadful calamity near Bilston, entailing the violent death of twenty-eight persons, has induced me to trouble you with a few observations on boiler explosions. These so-called accidents arise in the great majority of cases simply from the circumstance that, from original faulty construction or subsequent wear, the material is unable to withstand the requisite pressure. Since the lamentable catastrophe at Mr. Sharp's works, I have uniformly maintained that explosions are always the result of culpable ignorance or negligence—ignorance of the use and necessity of a proper hydraulic test, or neglect of it if known. I am aware that some have pretended that the hydraulic test is injurious to the boiler, and hastens the subsequent explosion. There is no foundation for this opinion. On the contrary, it is certain that if a material, say an iron-wire, has supported a weight for a short time, it may be relied on to support a weight a trifle lighter for a long time afterwards. Besides, I would ask why a test should be refused in the case of steam boilers, when it is applied, as a matter of course, to rifles, cannon, chain-cables, &c. I long ago pointed out, in your columns and elsewhere, a method of testing boilers by hydraulic pressure, in which the conditions of strain under actual work were approximately fulfilled. This method involves scarcely any trouble, and no expense, consisting simply in the use of the expansion of water by heat. Had a pressure one-third greater than the working pressure been so applied from time to time to the Bilston boiler, its weakness would have been long ago exposed, and the loss of life would have been prevented. In suggesting the above test, I was not influenced by merely theoretical considerations I had repeatedly tested the boiler of a small steam engine employed for scientific researches at Whalley Range. I would ere now have been in the possession of ample details on this subject, so important to humanity, had I not at my present residence met with an unexpected and certainly most uncalled-for opposition to my experiments. However, though unable to show the application of the test to my own boiler, I shall have great pleasure in assisting anyone who may wish to make use of it."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment :—

Steam Engines, &c. 2655, 2671, 2708.

Boilers and their Furnaces, &c., 2646, 2654.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2632, 2652, 2653, 2660, 2668, 2680, 2687.

Ships and Boats, including their fittings, 2644, 2681, 2697, 2701, 2705.

Cultivation of the Soil, including agricultural and horticultural implements and machines, 2641, 2647.

Food and Beverages, including apparatus for preparing food for men and animals, 2640, 2665, 2677, 2686, 2710.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2634, 2645, 2650, 2651, 2684, 2685, 2689, 2712.

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c. 2678, 2691, 2691.

Lighting, Heating, and Ventilating, 2658, 2711.

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2639, 2640, 2642, 2659, 2672, 2673, 2674, 2676, 2690, 2693, 2709.

Metals, including apparatus for their manufacture, 2637, 2643, 2664, 2669, 2707.

Chemistry and Photography, 2695, 2700.

Electrical Apparatus, 2656, 2661, 2682.

Warfare, 2633, 2679, 2703.

Letter-Press Printing, &c. *None.*

Miscellaneous, 2635, 2636, 2638, 2648, 2657, 2662, 2663, 2666, 2667, 2670, 2675, 2683, 2692, 2696, 2698, 2699, 2702, 2704, 2706.

2632. J. H. Johnson. *Improvements in apparatus for facilitating the passage of trains up steep gradients on railways.* (A communication.) Dated Oct. 21, 1861.

Here it is proposed to attach to the front of a train a peculiar apparatus consisting of a frame mounted upon two four-wheeled "bogies" at the front and rear ends. The centre portion of this frame carries two shafts which are each provided with a fast and loose grooved pulley or drum. Round the two fast pulleys or drums is passed a flat rope, guided on to them by the loose pulleys, and having one end fixed in a permanent manner at the top of the incline or gradient, whilst it is kept distended by a heavy counterweight at its opposite end or bottom of the machine. Rotatory motion is imparted to the fast pulleys or drums, so as to cause the train to wind itself up the incline by means of an endless travelling rope, extending along the incline, and actuated both at the top and bottom end thereof, by any convenient prime mover, one of which acts upon the descending part. The ascending side of the endless rope is passed round a grooved pulley fast on the end of one of the drum-shafts, and the descending side of the same rope is passed round a grooved pulley fast on the end of a central shaft, situate between and parallel to the two drum-shafts. This central shaft carries a friction-wheel or pinion which imparts motion to two larger friction wheels respectively, keyed on to the two drum shafts, and bearing upon opposite sides of the circumference of the central friction wheel or pinion, against which they are forcibly held by the tension of the flat hauling rope passing round the drums. On motion being imparted to the endless rope, the hauling drums are rotated, and by acting upon the stationary hauling rope, wind up the train, the rope passing over the drums and being left on the line as the train passes over it. *Patent completed.*

2633. J. Toward. *Improvements in armour-plates for ships and in securing the same to the sides of a vessel.* Dated Oct. 21, 1861.

This refers to the construction of the back or the inner sides of armour plates for ships, whereby they may be secured to the sides thereof without weakening the plates by having holes drilled in them, or exposing the heads of the bolts or fastenings on the outer surface of the plates. A series of ribs or feathers are formed in the backs of the plates, and such ribs or feathers are planed to a dovetail section. In attaching these plates, bolts are used, having their outer ends made to fit accurately, or grip the dovetailed ribs or feathers, and so hold the plates firmly against the ship's side without passing through the armour-plates. *Patent completed.*

2634. W. Connell. *Improvements in machinery for washing fabrics, yarns, wools, clothes, and other similar articles.* Dated Oct. 21, 1861.

This consists in the use of a washing vessel mounted upon wheels, and running upon trains or guide rails. Above this vessel is arranged an oscillating lever, to which is jointed one or more rods carrying a series of beaters or stampers, which are made to descend on to the goods in the washing vessel, and to rise again alternately by imparting a vertical vibratory or oscillating motion to the lever beam through the intervention of suitable cams, tappets, or wipers, driven either by power or by hand. This lever beam is provided with an adjustable counter-weight, whereby the power of the blow or the descent of the beaters or stampers, may be regulated to any desired extent. During the action of the beaters or stampers the washing vessel is caused to travel to and fro along its rail, by a rack and pinion, or other mechanical contrivance. *Patent abandoned.*

2635. H. Frost. *Improvements in apparatus for measuring fluids.* Dated Oct. 22, 1861.

This consists in an improved piston for fluid meters, the packing rings of which are sprung into grooves formed in the periphery of the piston plate, or the ring may be formed in the periphery of the piston plate. The invention also consists in an improved valve, consisting of a movable plate for covering the ingress and egress ports, and a movable chamber or cover fitting on a rib or mid feather cast or fixed on the plate. There are also other details which we cannot devote space to here. *Patent completed.*

2636. G. Boland. *Improvements in planing machines.* Dated Oct. 22, 1861.

This relates to apparatus for planing curved surfaces in iron or other metals, or hard substances, and consists in securing the planing tool to an arm or holder which is suspended from a stud centre at its upper end, and is, consequently, capable of being moved or adjusted laterally thereon, so that the tool will describe the arc of a circle, the radius of which depends on the length of the arca, whilst facility is at the same time afforded for adjusting the height of the working centre by a screw spindle for regulating the depth of cut. *Patent completed.*

2637. R. Mushet. *An improvement or improvements in the manufacture of a certain metallic alloy.* Dated Oct. 22, 1861.

The patentee claims manufacturing a triple metallic compound or alloy of iron, titanium, and manganese, containing also carbon, by smelting in a blast furnace or cupola furnace, heated with coal, coke, or charcoal fuel, a mixture or combination of that variety of titanium ore called ilmenite and spathose iron ore, or other manganesic ore of iron containing much oxide of manganese, so as to reduce the iron, titanium, and manganese in the said ores, or a portion of the said iron, titanium, and manganese to the metallic and alloyed state. *Patent completed.*

2638. P. O. Ward. *Improvements in hydraulic presses and in the machinery and apparatus appertaining thereto, and requisite in working the same, part of such improvements relating to the pumping machinery attached to hydraulic presses, and this part being applicable to pumping machinery employed for other purposes.* Dated Oct. 22, 1861.

Here the object is to diminish the weight of metal, and the number of working parts hitherto deemed necessary in hydraulic presses and the apparatus connected therewith, and to combine increased relative strength with easier and cheaper construction, more compact disposition, greater portability, less risk of bursting, and generally more economy and efficiency, than have been before attained. The specification of the invention is unusually elaborate. *Patent completed.*

2639. H. May. *Improvements in goloshes.* Dated Oct. 22, 1861.

This consists in making the back part to rise up at the back of the heel and ankle to a point, say two, three, or more inches above the ankle, and to be fastened around the ankle by a strap. *Patent completed.*

2640. H. B. Fox. *Improvements applicable to iron and other metallic bedsteads.* Dated Oct. 22, 1861.

This consists in adopting and applying wooden foot boards and wooden cornices to iron and other metallic bedsteads, and, in the case of French bedsteads, also a wooden head board; and in some cases the patentee proposes to attach false or hollow covering posts to the foot board, and also to the head board in French bedsteads. *Patent completed.*

2641. R. A. Brooman. *Improvements in reaping machines.* (A communication.) Dated Oct. 22, 1861.

The object of the present invention is to obtain the delivery of the cut crop from the side of the platform of the machine. The invention consists in the employment of a rake head to take the place of one of the ribs or vanes of the reel in gathering the crop to the platform, which rake head is made to act as hereafter explained. The teeth of the rake project beyond the other ribs and come close to the platform. When the rake head reaches over the platform at the cutting blades, it leaves the circle of the reel and passes over the surface of the platform in a horizontal direction, or nearly so, and pushes or pitches the cut corn or other crop from off the side of the platform; the rake then rises and regains its position as a rib or vane of the reel. The rake is connected with machinery which works it by means of an arm. The machinery consists of an excentric with a pulley fastened to the reel post, in connection with a crank and levers attached to the reel shaft, the end of which passes through the vertical excentric. *Patent abandoned.*

2642. G. Archer. *Improvements in sewing boots and shoes.* Dated Oct. 23, 1861.

This invention is carried into effect as follows:—After the patentee has lasted the boot or shoe, he tacks the welt all round, and pierces upright holes for the stitches straight through the said welt and the upper leather and insoles; he then takes out the last and turns back the insole to the toe of the boot or shoe, and then takes two threads and begins sewing at the middle of the toe, using one of the said threads for sewing one side of the boot or shoe, and the other for sewing the opposite side, working each of the said threads alternately, until he gets where the heel is placed. He then puts in the said last again, and afterwards sews the "seat," and finishes the boot in the usual way. *Patent completed.*

2643. G. H. Birkbeck. *Improvements in separating or extracting silver from lead.* (A communication.) Dated Oct. 23, 1861.

This consists in a series of processes for separating silver from lead by incorporating zinc therewith. *Patent completed.*

2644. A. Bevan. *Improvements in the construction of iron vessels and iron-plated ships of war.* Dated Oct. 23, 1861.

That part of this invention which relates to the frames of ships consists in the substitution for the ordinary single or double angle irons, and the riveting together thereof, of a series of rolled bars of suitable sections, combined together chiefly by dovetails, and framed or secured together in a box-like form, placed at suitable intervals apart, they in turn forming, in conjunction with the horizontal strengthening pieces, stringers, or their equivalents, a series of cellular divisions, by which the surface of the plating is supported in the greatest number of parts, or the unsupported are reduced to a minimum. The patentee rolls armour plates with ribs at the back thereof, and by means of certain dovetailed grooves the plates are, as it were, clamped together. *Patent abandoned.*

2645. S. Young. *Improvements in the spindles and flyers of machinery employed for spinning and twisting flax, hemp, jute, cotton, silk, wool, and other fibrous substances.* Dated Oct. 23, 1861.

This consists in a mode of constructing the spindles of spinning and twisting machines, and of combining the flyers therewith, and connecting the bobbins thereto, whereby the twisting spindle and flyer can be driven at any desired speed without vibration; and, further, in making the bobbin spindle revolve with, but only at the same speed as the bobbin, and its blade not to project above the bobbin, whereby the inventor is enabled to make this part of the spindle very small in diameter, and, consequently, also the barrel of the bobbin. *Patent abandoned.*

2646. C. Briston and A. Chavanne. *Improvements in ovens, kilns, or furnaces for manufacturing and other purposes.* Dated Oct. 23, 1861.

The patentee claims providing ovens, kilns, or furnaces to which retorts are or may be used for various purposes with vertical retorts, each of them provided with a suitable movable lid, and also with a movable obturator for closing or opening at pleasure the bottom of the retort, this obturator being jointed to a lever for allowing the easy and effectual working of the same, substantially as described. *Patent completed.*

2647. J. W. Wilson. *Improvements in machinery for digging and cultivating the soil, and in steam-engines for agricultural purposes.* Dated Oct. 22, 1861.

This digging implement consists of a revolving shaft furnished with an eccentric connected by links to crank shafts, to which are attached spades and picks, so that the spades and picks enter and are drawn out of the soil at any angle to its surface, whereby the operations of loosening and turning the soil are affected with less power and more effectually than heretofore. The improvements in steam-engines for agricultural purposes consists in mounting the bearing wheels on brushes through which the crank shaft works. The leading or guiding wheels are acted upon by a steering apparatus consisting of a worm and worm wheel and pinion and sector, or other equivalent arrangement of parts. The speed of the engine is reduced to suit the speed of the bearing wheels by a counter shaft, which is driven from the crank shaft by pulleys and chains, or by gearing, and the counter shaft is provided with a set of different wheels for equalising the action of the chains or gearing in going round curves. *Patent abandoned.*

2648. H. Keach. *Improvements in the manufacture of cigars.* Dated Oct. 23, 1861.

This consists in enveloping that part of the cigar which, in smoking, is placed in the mouth with a cap or cover of metal, the said cap or cover being applied by pressure or by an adhesive substance. *Patent abandoned.*

2649. J. F. V. Delery. *An improved mechanical kneading trough.* Dated Oct. 23, 1861.

This invention consists of a cast iron annular basin, into which is placed the bread stuffs for working them. This basin, which is carried by three or more rollers, revolves around a central vertical steady shaft. The required rotary motion for working the dough is given to the basin either by a hand crank, or a band running on a pulley keyed on a horizontal shaft carrying a level pinion, which pinion cogs with a tooth crown fastened under the bottom of the basin. *Patent completed.*

2650. A. Morel. *A new machine for combing all filamentous materials.* Dated Oct. 23, 1861.

This invention consists in a new application of the nipper or pricker, whether double and swinging like a balance beam, or in two separate parts acting alternately, to effect the combing, using a circular comb or an articulated or jointed one. This nipper or pricker, which itself deposits n the comb the fibres which it has picked, at once quits them in a suitable manner, and without disturbing their position. *Patent completed.*

2651. J. Kirkwood. *Improvements in looms for weaving.* Dated Oct. 23, 1861.

These improvements are contrived to permit of the application of steam or similar motive power, and in one modification of a loom embodying them are combined with jacquard pattern mechanism of the single lift class. This jacquard mechanism acts on the warps by means of the ordinary harness mounting, and a set of heddles; it is also made to both regulate and effect the changes of the shifting shuttle boxes, and at the same time to both regulate and effect the picking movement. *Patent abandoned.*

2652. I. Davies. *Improvements in railways and in iron pavements and railways combined, parts of which improvements are applicable to the construction of railway chairs, and to cast-iron pavements for ordinary streets.* (A communication.) Dated Oct. 23, 1861.

These improvements consist, 1, of a railway composed of two or more cast-iron girders constructed and bedded directly into the ground, so as to dispense with the usual wooden sleepers or other foundations, as well as with the ordinary chains and spikes. 2. In combining cast-iron girders as above (bedded into the ground), with malleable iron rails, for the purpose of readily removing and replacing the rails without displacing the girders, and in confining the said rails to the girders. 3. Of a combined railway and pavement constructed so that the wheels of ordinary vehicles can freely traverse the pavement without being obstructed by the rails, the said pavement being so arranged that any portion may be readily removed without disturbing the whole pavement or raising the adjacent parts. *Patent completed.*

2653. R. Chanmond. *Improvements in self-acting railway signals.* Dated Oct. 23, 1861.

According to these improvements a lever is arranged at the side of the rail and nearly upon a level with it, so that the lever may be depressed when the engine passes over the spot. This lever is fast to one end of a horizontal rod which extends outwards in a lateral direction, and has fitted near to its other end a vertical lever which is connected to a wire, cord, or chain and counter weight, or helical or other spring. The counterweight is attached to one end of the cord or chain, and the other end is carried up the signal post, and is made fast to a spring catch. This catch is immediately contiguous to the inner end of the signal arm, and when the weight is free it draws back the spring catch out of the way of the signal arm. *Patent abandoned.*

2654. J. H. Johnson. *Improvements in preventing and removing deposit in steam boilers and other vessels, and in the apparatus employed therein.* (A communication.) Dated Oct. 23, 1861.

For the prevention of deposit in steam generators or boilers it is proposed to apply to the interior of the water space of the boilers any convenient number of rotating screws or vanes, or spirals, which latter are placed either inside the tubes when the water is contained therein, or outside the same when the tubes act as flues, but in all cases the screws or spirals are situate in the water space of the boiler, and are either rotated by the action of the circulation of the water and the ascending steam bubbles. The details are voluminous. *Patent completed.*

2655. J. Marshall. *Improvements in traction engines and wheels, and in carriages to be drawn by traction engines, which improvements in wheels are applicable to common road carriages generally.* Dated Oct. 23, 1861.

This invention in traction engines consists, in placing the driving pinion which gears into the inside toothed rack of the driving wheels either on a line with and forward or below and forward of the axes of the driving wheels. This pinion slides between horn plates or other suitable guides in the framing in a vertical direction, to allow of the play of the springs by which the weight of the engine is supported when at work upon the driving pinion, the pinion is connected with the engine by suitable wheels and pinions to produce the requsite changes of speed. The axes of the driving wheels also slide in the framing, by having the axle boxes sliding in horn plates or other suitable guides, curved with a radius equal to the distance of the driving pinion first mentioned from the centre of the drawing wheel. When the engine is standing still the weight taken by the driving wheels is supported by the springs at their centre; but so soon as the engine is put in motion, according to the power required to move the engine and its load, so much of the weight of the engine is transferred from the centre of the driving wheel to that point in the circumference where the driving pinion gears into the toothed rack upon the driving wheel, and the amount of weight thrown upon the pinion is taken off the centre of the driving wheels so that if the driving wheels were fixed the whole weight of the engine would be transferred from the centre towards the circumference. By this arrangement of the driving pinion the weight is transferred from the centre of the wheel or line of direct vertical pressure towards the circumference to a distance equal to the horizontal distance between the centre of the driving wheel and the driving pinion, by which the wheel is compelled to roll forward or slip with a power equal to the weight of the engine, acting upon a lever whose length is equal to the horizontal distance between the centre of the wheel and the pinion. The improvements in carriages to be drawn by the traction engine are as follows:—the inventor fits a toothed rack inside the felloe or periphery of the hind wheels, or both fore and hind wheels having a pinion gearing into and fitted in a similar manner to the engine before described, and driven by a horizontal shaft extending along the bottom of the carriage and connected to the engine by suitable couplings and gearing. The improvements in wheels for traction engines and other common road carriages, consists in placing within the rim or felloe of the wheel a raised rail, the spokes being placed either within or without the centre of the felloe or both. He divides the wheel into four quarters by lines drawn horizontally and vertically through the centre; within the wheel he places a frame with two arms; this frame is keyed or bolted to the axle, and on the aftermost arm he places a grooved roller bearing against and embracing the raised rail within the felloe of the wheel, at a point either upon or a little below where the horizontal line separating the upper from the lower aftermost quarter cuts the felloe; on the other arm he places another grooved roller bearing upon and embracing the raised rail within the felloe at or near a point about the middle of the lower foremost quarter. By thus constructing the wheels a portion of the weight is (by the forward pull in drawing the carriage) thrown in advance of the line of direct pressure of the wheel upon the ground. *Patent abandoned.*

2656. J. L. Pulvermacher. *Improvements in apparatuses for the production of galvanic and magneto-electric currents, and in machinery employed in making some of the apparatuses.* Dated Oct. 23, 1861.

This invention will be specially noticed in a future number. *Patent completed.*

2657. W. B. Lord. *An improved plug and socket, or apparatus for closing and opening passages for the flow of liquids and fluids.* Dated Oct. 23, 1861.

This invention consists of a portion of a ball, with handle for altering its position, and of a socket with a portion cut away, through which the liquid or fluid is to be allowed to pass or stopped from passing, according to the position of the ball. The invention combines a slotted guard with the apparatus for the handle to work in. *Patent completed.*

2658. G. Davis. *Improvements in lamps for burning coal oil and similar fluids.* (A communication.) Dated Oct. 24, 1861.

These improvements relate to a peculiar construction of the burners of lamps for condensing coal oil and other like fluids, the burners being so arranged as to direct currents of heated air to support combustion and to spread the flame, and thus effectually to prevent the smoke which usually accompanies the flames of this class of lamps, so that the usual glass chimney may be dispensed with. The improvements further relate to a mode of attaching the burner to the reservoir of the lamp without the aid of the usual screw, and to a means of replenishing the reservoir without detaching the burner therefrom. *Patent abandoned.*

2659. J. Baker. *An improvement or improvements in ever-pointed pencil cases.* Dated Oct. 24, 1861.

This invention consists in making the lead holder of ever pointed pencil cases hollow from end to end, and also making the pencil case open at its top, by which construction the introduction of a fresh lead is facilitated, it only being necessary in inserting a fresh lead to press the end of the lead into the lead holder as though the said lead holder were empty. *Patent abandoned.*

2660. A. F. Campbell. *Improvements in railways.* Dated Oct. 24, 1861.

These improvements consist in applying a central rail along the line of way adapted to receive or act on suitable wheels between the bearing wheels of the carriages, for the purpose of preventing the carriages running off the line of way, whereby wheels with a plain or unflanged surface may be used as the bearing wheels. *Patent completed.*

2661. T. Morris, R. Weare, and E. H. C. Monckton. *Improvements in magnets, induction coils, and in insulating wire and metal for electric and other purposes.* Dated Oct. 24, 1861.

This invention refers to two previous patents, dated respectively, March 10, 1860 (No. 653), and Sept. 14, 1861 (No. 2298). The patentees make and use permanent magnets cast in suitable forms from cast iron, which are to be decarbonized by any of the known methods, so that they may be rendered sufficiently soft to fil, drill, fit, or be otherwise operated upon. They are then to be recarbonized, hardened, and magnetized, by which means these magnets can be made cheaper and more uniform than those made from steel. *Patent completed.*

2662. J. C. Heaton and J. Dean. *Improvements in the construction of taps and cocks.* Dated Oct. 24, 1861.

This relates to taps or cocks suitable either for high or low pressure service, whereby considerable economy and simplicity are obtained. According to one arrangement this tap or cock is composed simply of three or four parts, viz., the barrel, the valve, and a screw cap, or screw cap and spindle, the screw cap when used without the screw spindle serving the threefold purpose of the plug, the crutch, and the cap. *Patent completed*

2663. W. Dicks. *Improvements in water meters.* Dated Oct. 24, 1861.

This relates to a peculiar construction and arrangement of low pressure water meters, whereby greater economy, simplicity of construction, and increased accuracy of measurement are obtained. According to this invention it is proposed to employ syphons in combination with suitable floats and oscillating conducting spouts. The syphons are contained in two separate water chambers, these chambers being placed side by side over a larger water chamber or tank, from which the supply is drawn off when required for use. An oscillating conducting spout is placed on the partition which separates the two syphon chambers, and is so arranged as to turn over and direct the supply from the service pipe into each chamber, alternately, such oscillating motion of the conducting spout being made to transmit movement to any suitable registering or counting apparatus. *Patent completed.*

2664. J. Chesterman. *Improvements in heating steel and iron, and in hardening and tempering steel, and in apparatuses employed therein.* Dated Oct. 24, 1861.

Steel has heretofore been passed in a naked state through molten metal, generally lead, for the purposes of heating it for hardening and tempering, but inconveniences have attended the process, and from the lead having been exposed to the atmosphere oxidation and loss have ensued. Now the first part of this invention consists in enclosing the lead or other metal or material to be melted, and in protecting it from the atmosphere in a suitable bath or vessel, and in forming a passage or passages through the same by means of tubes or otherwise, through which the ribband or other steel or iron article to be heated, hardened, or tempered, may be drawn without coming in contact with the molten metal or material. In the next place in lieu of molten metal, this invention consists in the employment of what the patentee hereinafter terms a flux, consisting of chloride of sodium, or common salt, soda ash, sal-enixum, chloride of zinc, chloride of potassium, chloride of calcium, alum, borax, either together or separately, or of any other mineral or compound of minerals which will become liquid under heat, and at such temperature as will be suitable for properly heating iron or for heating steel, for hardening and tempering, either in open or closed vessels, but the higher the degree of heat required the greater should be the proportion of soda ash or sal-enixum. The steel article to be hardened or heated, or both, is passed into and through the flux while in a hot and melted state. The steel being kept from the action of the atmosphere no scale or oxide results. Those articles requiring to be hardened or tempered when removed from the melted composition, are immersed in oil or water, or in any other fluid capable of effecting a similar purpose. *Patent completed.*

2665. J. Mc'Call and B. G. Sloper. *An improvement in the preservation of articles for food.* Dated Oct. 24, 1861.

This invention consists in introducing into the tins some material or composition for which oxygen has a greater affinity than for the meat or other article of food under preservation, and which at the same time shall be in no way detrimental to it. The patentees have found in practice that sulphite of soda is the best agent for their purpose, but they do not confine themselves to the use of that substance only. They prefer to encase or cover the sulphite of soda or other suitable material in composition as aforesaid, in gelatine or other suitable protecting coat, to prevent its coming into action before the coat has been dissolved by the heat to which the tin and contents are first subjected, and the time of its solution they vary according to circumstances. About the time they have calculated for its solution, they hermetically seal the tin, and then for a short period apply a higher degree of heat, when the oxygen remaining in the tin and in the meat or other food will combine with the sulphite of soda. *Patent completed.*

2666. R. A. Boyd. *Improvements in apparatus for singeing pigs.* Dated Oct. 24, 1861.

This improved furnace or fire-place consists of a series of bars let into two rings one at top and the other at bottom, and of a cylinder or grating placed behind, and at some distance from the series of bars. The fuel is placed between the bars and the cylinder or grating. The fire-place is supported at some distance from the ground, to allow of air passing up into and through the fuel to support combustion. To prevent loss of heat by radiation, the patentee surrounds the outer cylinder with brickwork or fire clay. *Patent completed.*

2667. E. S. Tucker and F. E. Manners. *The construction of revolving and movable surfaces applicable to the exhibition of advertisements, show cases, transparencies, and other like matters at fixed stations.* Dated Oct. 25, 1861.

Here the inventors construct large drums of timber, iron, zinc, canvas, glass, paper, paper maché, vulcanite, gutta percha, leather, &c., on the exterior surfaces of which they place advertisements, show cases, patterns, and illustrated and illuminated devices of any description. *Patent abandoned.*

2668. W. Wharton. *Improvements in the manufacture or construction of springs for railways or other vehicles.* Dated Oct. 25, 1861.

Here the patentee first takes a bed plate of suitable material of the full length of the spring required, its end being turned into a solid or rolled eye or loop, suitable for the ordinary attachments. He takes a second plate which overlaps or turns downwards, enclosing the edge of the bed or bottom plate, and upwards to receive and enfold the edges of the upper or third plate, forming a T edge on both sides of the plate all the additional plates used in making the spring, are fitted consecutively as first explained, or in the same manner; the length of each of the plates used in making the spring is governed by the ordinary calculations. *Patent completed.*

2669. E. Chambers. *Of the use of hydraulic power for the breaking, crushing, or pulverizing of quartz, blue stone, or other stone or mineral of any description, and the use of a wrought iron lever or jaw in machines for crushing quartz or other mineral, and the use of steel teeth and steel shield pieces for the levers or jaws of such machines.* Dated Oct. 25, 1861.

As a means of gaining power the patentee proposes to apply a hydraulic machine with the rams acting direct on a compound lever or jaw, and to attach to the frame of the machine a cylinder (to be worked by steam, water, or other agent) with the plunger-rod of a hydraulic ram continued (as shown in drawings), whereby the machine is not encumbered with any revolving shafts or gearing of any description, and, therefore, friction is done away with. *Patent completed.*

2670. C. N. May. *Improvements in garden pots.* Dated Oct. 25, 1861.

This invention consists in forming earthen and other porous ware pots with a cup or basin surrounding it on the exterior, about midway of the height of the pot; or there may be two or more such basins disposed at different heights on the exterior of the pot. The inventor places water in the basins, which, by reason of the porosity of the pot, penetrates it, and moistens the earth inside, and so feeds the roots of the plants. *Patent abandoned.*

2671. E. and E. Green, jun. *Improvements in apparatuses for generating, superheating, and condensing steam.* Dated Oct. 25, 1861.

This invention in apparatuses for generating and superheating steam consists in constructing them of a series of vertical or inclined tubes, let into or attached to horizontal tubes or boxes at top and bottom, for the purpose of getting at the tubes for cleansing and for removing sediment, also for blowing off; and, in enclosing the tubes and furnace in a wall or casing composed of other tubes, the sides of which are planed or cemented, or otherwise formed so as to fit closely together and form a tight joint. Instead of all the tubes in the generator being horizontal and vertical, those forming or enclosing the furnace may be circular or curved. When the apparatuses are to be used as condensers the furnace is dispensed with, and a water reservoir is placed over the horizontal tubes, with apertures in the bottom through which a film of water is allowed to trickle down the outsides of all the pipes. The patentees cause a strong draught, by means of a fan or otherwise, to draw away the steam generated by the water coming in contact with the heated pipes or heated air, and at the same time to cause a continuous indraught of air through and among the pipes. Under some circumstances they condense with air alone, and sometimes with air and water, and in some cases also they apply the water inside the tubes. The condensed steam is employed for feeding the boilers with water. They keep the exterior of the pipes, whether for generating or condensing purposes, clean by means of scrapers made to run up and down the tubes. When generating and superheating steam they maintain the water level at some distance from the top of some of the vertical tubes, in order that the steam occupying that space may be dried or superheated. Although they have described the outer case or wall as being formed of tubes, yet it may be made of brickwork or other suitable material. The invention lastly consists in the employment for the vertical tubes of pipes, corrugated or indented longitudinally, or of a hexagonal, octagonal, or many-sided form, in section, in order thereby to obtain increased surface and greater facility for scraping the same. *Patent completed.*

2672. S. Oppenheim. *Improvements in the manufacture of printed shirt fronts.* Dated Oct. 25, 1861.

This consists in printing on calico, linen, &c., the middle fold, and also the arrangement of the folds of the front at the same time. *Patent abandoned.*

2673. L. Aron. *Improvements in cravats and their mode of attachment.* Dated Oct. 25, 1861.

This consists in the employment of a ring or slipping noose, having one or several fixed or jointed small bars, through which pass the two ends of the cravat, the small bars forming the point of support, by this means the rumpling of the stuff is prevented, and at the same time the cravat is kept tight at the proper place. *Patent abandoned.*

2674. E. Alexander. *A pedal box for musical instruments.* Dated Oct. 25, 1861.

This consists in the construction of a box capable of containing in its interior and carrying about a flutina or organ of small size, or other similar instrument when not in use. This box answers the purpose of a foot or support to the instrument when played upon. It also contains a pedal which is moved with the foot to work a bellows, and the whole may be placed under the key board of a piano to play two instruments at the same time. *Patent completed.*

2675. T. Moore. *Improvements in windlasses and in checking or stopping chains worked thereby.* Dated Oct. 25, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2676. J. B. Schalkenbach. *A new kind of musical instrument of the pianoforte class, including harmoniums and organs.* Dated Oct. 12, 1861.

This relates to combining several musical instruments in one case, so as to constitute one compound instrument, which the patentee designates an "orchestral piano," and consists, 1. In adapting certain instruments the sound of which is produced by percussion to harmoniums, pianofortes, and other keyed instruments in such manner that the performer may play them with the hand or arm without interrupting the execution of the piece of music. 2. In a particular construction of the marching drum, for the purpose of this invention, so as to obtain by means of keys the greater part of the effects which a clever drummer could produce with the ordinary drum sticks. 3. In a peculiar contrivance applicable to harmoniums, organs, &c., by which the keys may be temporarily locked or set in order to leave the performer at liberty to play on the percussion instruments, while the cords or tones of the instrument are sustained or prolonged when certain effects are to be produced. 4. In the application of a series of metal funnels or mouth pieces to the sound holes of harmoniums and other instruments, by means of which, and a corresponding action of the tremolo valve, a tone is produced which imitates that of a trumpet or tabour. *Patent completed.*

2677. T. Richardson. *Improvements in treating bones and gelatine.* Dated Oct. 25, 1861.

This consists, 1, in treating bones with muriatic acid, or weak sulphuric acid, to dissolve out a portion of the mineral matter they contain, and in subjecting the bones so treated to the action of sulphurous acid. 2. In treating bones with sulphurous acid to dissolve out a portion of the mineral matter they contain, and in subjecting the bones so treated to the action of muriatic acid, or weak sulphuric acid. 3. In treating the gelatine obtained from bones by either of the above plans, or by muriatic acid alone, with the sulphates, sulphites, hypo-sulphites, phosphates, or silicates of the alkalies, or with a solution of the dis-phosphates of lime, and magnesia in sulphurous acid. 4. In increasing the sizing properties and hardness of gelatine from any source by the addition of one or more of the phosphates of lime and magnesia, or the silicates of the alkalies and bichromate of potash. *Patent abandoned.*

2678. H. Gilson. *Improvements in slate dressing machines for cutting and trimming the edges of slates.* Dated Oct. 25, 1861.

This machine consists of a wheel, working on a horizontal axis fixed upon a strong frame, with two, three, or more knives, for cutting and trimming slates, fixed at equal distances on the side of the wheel; or if two slate cutters work at the same wheel, then another set of knives may be fixed upon the other side of the wheel in alternate order. The knives should be fixed at such distances from the spokes of the wheel as to admit of the slate being presented to the knife, without the projecting end coming in contact with the spokes of the wheel. The knives should be of sufficient length to cut the sides of the largest slates in ordinary use. The size of slate to be cut will be regulated by gauges fixed in the usual manner in slate dressing machines. *Patent completed.*

2679. J. Lobb. *Improvements in gunpowder suitable for blasting.* Dated Oct. 25, 1861.

For the purpose of this invention the inventor substitutes sawdust for a portion of the charcoal and sulphur in the powder. He also adds to the powder a quantity of lime. The object of the use of sawdust is to render the smoke arising from the explosion of the powder in a confined place less offensive, and to allow of the quantity of sulphur being reduced; and the object of the addition of lime to the powder is to counteract the deliquescent property of the nitrate of soda or nitrate of potash employed in the manufacture of the powder, and is more especially useful in the manufacture of powder to be used underground, or in damp situations. *Patent abandoned.*

2680. B. J. La Mothe. *Improvements in the construction of metallic railroad car and other vehicles.* Dated Oct. 25, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2681. N. Cox. *Improvements in the mode of connecting and attaching armour-plates when applied to ships, forts, batteries and such like.* Dated Oct. 26, 1861.

In carrying out this invention, instead of bolting the armour-plates directly to the sides of the vessel, the inventor fastens T or angularly shaped pieces to the sides, skin, or sheating, in a vertical position, by means of flanges in the usual manner. In the armour-plates corresponding grooves are cut, coinciding in outline with the angularly shaped pieces, and then slips or slides the plates on to them. Firmness to the whole is rendered, by grooving the sides, tops, or bottoms of the plates. By this means he avoids the holes which weaken the sheathing and plates, and facilitates the changing or removal of the plates when damaged. *Patent abandoned.*

2682. F. Barnett. *Improved electric danger signals for railways and other cognate purposes.* Dated Oct. 26, 1861.

The inventor proposes that between all stations on railways, there shall be on each side of the line tall posts erected, surrounded by round balls or other shaped signals of sufficient size to be seen afar. These signals are to work in grooves, and be sustained in their places each by a catch connected with a galvanic pile or battery. By means of the communication between the said galvanic battery and the moveable ball or other shaped signal, the person at the station in charges will be able, by completing the circuit of electricity, to cause those moveable signals to fall from the upper to the lower part of the grooves on the signal post. *Patent abandoned.*

2683. M. A. F. Mennons. *Improved apparatus for ascertaining the presence and degree or cessation of vitality in the human body and in animals of the higher class, applicable to the semeioses of health, disease, and death.* (A communication.) Dated Oct. 26, 1861.

This invention consists in a novel combination of acoustic instruments, by the aid of which the variable degrees of animal vitality in health or disease may be translated into signs of known value, and by which the transition from life to death may be verified with absolute certainty. *Patent completed.*

2684. W. Robertson and J. M. Hetherington. *Certain improvements in mules for spinning and doubling.* Dated Oct. 26, 1861

This consists, 1, in effecting the removal of the coils of yarn on the spindles, between the point of the cop and the point of the spindle, by combining a partial amount of stripping with a partial amount of backing off. 2. In an improved form of cop builder. 3. In a combination of parts by which the rising of the counter faller in backing off mules, and the position of the stripper at the commencement of the inward run, are determined by the descent of the building faller. 4. In an arrangement of parts by which the motion of the winding on quadrant is regulated by the motion of the carriage. 5. In liberating the catch by which the cam shaft is detained, at or near the determination of the inward run of the carriage, by the rise of the building faller or the descent of the faller rack. 6. In a break regulated by the counter faller acting on one portion of a differential motion, the other portion of which is moved by the carriage or carriage motion. *Patent completed.*

2685. J. Sidebottom. *Certain improvements in machinery for cleaning and carding cotton and other fibrous materials, and for making partial tubes for the spindles and spinning and other machines.* Dated Oct. 26, 1861.

These improvements are applicable to those partial tubes that are made of sheet metal, and of a conical shape, as described in the specification of a patent granted to the present patentees on the 20th day of May, 1861, the object being to bend the sheet metal forming the base of the said partial tubes inwards, to fit the spindles or skewers on which they are to be placed. In performing this invention the larger end of the cone is provided with notches, and the metal between the notches is first bent partly inwards by a cup-shaped punch; after this preliminary operation, the final bending inwards of the metal is performed by another punch working upon the cup-shaped one, of the size of the spindle or skewer on which the partial tube is to be placed. A die is inserted into the open end of the partial tube, for giving the requisite inward bend to the sheet metal. *Patent completed.*

2686. J. L. Sirard. *An improved apparatus for purifying, measuring, and weighing grain and oleaginous seeds.* (A communication.) Dated Oct. 26, 1861.

This invention consists, first, in the construction of an apparatus for purifying, measuring, and weighing corn and oleaginous seed. Secondly, in the application to the leve of a Roman balance or steel yard of a ball for compensating for the differences of weight caused by the variation of temperature in the measures employed. *Patent completed.*

2687. F. Whatley. *Improvements in the construction o railway wheels and wheel tyres.* Dated Oct. 26, 1861.

This consists in the following construction and combination of parts applicable to new wheels. The tyre is made with two undercut recesses, one on each edge of its inner periphery forming a "dovetail," and the rim or sole plate of the wheel has a flange formed on one side which is under cut to correspond to the dovetail on one side of the tyre, and an annular ring is provided for the other side, which is shaped to fit the undercut recess in the tyre, and also to take hold of the underside of the rim or sole plate. When the tyre is placed on the wheel, the annular ring is then put on and secured by rivets or bolts passing through it and the rim or sole plate of the wheel breadthwise. *Patent abandoned.*

2689. J. L. Norton. *Improvements in beating, stretching, and drying fabrics, and in the apparatus employed therein, part of which apparatus is also applicable for thrashing linseed.* Dated Oct. 26, 1861.

This consists in effecting the operation by machinery, the fabric being caused to pass between two rows of sticks which are fitted into metal sockets, and in connection with these sockets are short arms or projections which, being acted on by lappets or shafts suitably arranged and driven, give the requisite motion to the sticks to cause them to strike the fabric. The beating of the fabric has to be done generally while it is damp, and it is very desirable that after it has been beaten it should be at once dried, so that the pile when properly raised may not be again deranged. For this purpose a beating machine is combined with a tendering, stretching, and drying machine, so that the former one may feed the latter, the fabric passing direct from the beaters on to the tendering points, and being kept extended from the time the beating commences until it is delivered dried at the end of the tendering, stretching, and drying machine. *Patent abandoned.*

2690. R. B. Greenwood. *An improved billiard rest* Dated Oct. 26, 1861.

This invention consists of a small carriage mounted upon two wheels, which are turned true, and accurately fitted upon the same axis. The carriage is provided with a split taper tube, by means of which it is readily adjusted on, and removed from the end of the cue. *Patent abandoned.*

2691. W. Taylor. *Improvements in joints or connections for metal and other pipes and tubes.* Dated Oct. 26, 1861.

This invention consists in forming a flange or collar on the ends of pipes and tubes, in making undercut grooves, two, three, or more, in the collars, and in the employment of dovetail cottars formed with a head at one end and with a slot or groove near the other for the reception of a key, which cottars slide into the grooves and are tightened up by the keys being driven into the slots. *Patent completed.*

2692 C. Stevens. *Improved apparatuses for indicating escapes of lighting gas from the conveying pipes and determining the precise leaking places of the said pipes.* (A communication.) Dated Oct. 26, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2693. G. Hutton *Improvements in hats, caps, and other such coverings for the head.* Dated Oct. 26, 1861.

This invention relates to a method of forming the hat or cap elastic, so as to fit heads of different sizes. For this purpose the patentee employs coiled springs of metal, constituting a portion of the circumference of the article. *Patent completed.*

2694. W. Smith. *Improvements in preservation of stone, brick, and other such materials used in building, applicable to the waterproofing of walls.* Dated Oct. 26, 1861.

In carrying out this invention the patentee takes flint or other such siliceous substance, and reduces it to a fine powder; if prepared after the manner of that used in the pottery trade it will be suitable for the required purpose. To this he adds alum or sulphate of alumina reduced to a fine powder. The composition thus formed he makes into a paint, which may be applied to stone, brick, or other material used in building, and will be found a protection against decay or damp. *Patent completed.*

2695. E. McClintock. *Improvements in the manufacture of soda and sulphuric acids.* Dated Oct. 28, 1861.

This invention consists partly in the substitution of copper, or any one of its compounds, reducible by coal for carbonate of lime as used in the ordinary soda manufacture; and further, in the reconversion of the original sulphuret of copper, obtained as before stated, into oxide of copper, or metallic copper, as the case may be; at the same time saving the sulphur for the manufacture of sulphuric acid, or sulphate of soda. *Patent abandoned.*

2696. B. Predavalle. *A new mode of, and apparatus for, producing and obtaining an hydro-pneumatic motive-power.* Dated Oct. 28, 1861.

This consists of an atmospheric pressure, imparting its gravitation on a column of liquid, communicating alternately with a cylinder under the piston, the rod of which fits air-tight into the upper part of the cylinder in which the vacuum is produced. *Patent abandoned.*

2697. G. W. Watson. *An improved mode or method of reefing fore and aft sails.* Dated Oct. 28, 1861.

In this invention the sail must be of the ordinary kind, the only difference being that it is made to turn round a boom placed on the top of the ordinary boom, and turned by means of a wheel fixed to the boom, which wheel will by no means interfere with the arrangement of any of the running gear, and can be used at any time, one or two men being sufficient for the purpose of reefing, according to the strength of wind and size of sail. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Dec. 31, 1861.

3266. F. Tolhausen, C.E., 35 Boulevart, Bonne-Nouvelle, Paris. A new method of, and machinery for, covering springs used for petticoats and other articles. (A communication.

Dated Feb. 1, 1862.

281. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improved processes for the recovery of the oleic acid contained in the residual scouring waters of woollen and other textile materials or fabrics. (A communication.)

Dated March 18, 1862.

746. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. An improved combination of cooling and filtering apparatus, forming a safe for the preservation of solid and liquid provisions. (A communication.)

Dated March 19, 1862.

763. R. Hadfield and J. Shipman, Attercliffe, Sheffield, wire drawers and manufacturers. Improvements in hardening and tempering wire and crinoline steel.

Dated April 5, 1862.

979. B. Thompson, Walker, near Newcastle-upon-Tyne. Improvements in steam engines.

Dated April 7, 1862.

988. J. Wartremez and A. Kloth, merchants, Aix-la-Chapelle. Improved apparatus for indicating a deficiency of water in steam generators.

Dated April 8, 1862.

999. J. Jacques, jun., 102 Hatton-garden. Improvements in the instruments used in the game of croquet. (Partly a communication.)

Dated April 11, 1862.

1032. J. Howard, agricultural engineer, & T. Bousfield, engineer, and T. Phillips, foreman, Bedford. Improved apparatus applicable to steam cultivation.

Dated April 15, 1862.

1077. C. J. Coxhead, 10 Emeris-terrace, Kentish-town. Improvements in pianoforte actions.

1078. G. Fell, leather manufacturer, and W. Haynes, manager. Improvements in machinery or apparatus to be used in the manufacture of leather.

Dated April 19, 1862.

1149. A. Parkes, Liverpool-street, Birmingham. Improvements in surface condensers.

Dated April 21, 1862.

1162. C. Callebaut, 2 Rue Sainte Appoline, Paris. Some improvements in sewing machines.

Dated April 22, 1862.

1168. S. S. Putnam, Dorchester, U.S. Certain improvements in machines for forging horse shoe nails and other articles.

Dated April 25, 1862.

1206. S. C. Salisbury, Coventry, engineer. Improvements in the construction of sewing machines.

1210. R. C. Mansell, Ashford, engineer. Improvements in the construction of wheels to be used on railways.

1214. J. Elder, Glasgow, engineer. Improvements in steam engines and boilers.

1216. J. Aspinal, Middlesborough-on-Tees. An improved apparatus for the safe conveyance from sea to land of ships' papers, documents, money, and other valuables when wrecks or other casualties occur at sea.

1218. A. C. Kirk, Bathgate, engineer. Improvements in refrigerating apparatus.

1220. W. Hale, 6 John-street, Adelphi, C.E. Improvements in rockets.

1222. L. McLachlan, Manchester, photographic artist. Improvements in governing or regulating light used for taking photographic portraits and other photographic pictures, part of which improvements is also applicable to lighting picture galleries.

1224. W. E. Newton, 66 Chancery-lane, C.E. Improvements in chimneys for lamps. (A communication.)

Dated April 26, 1862.

1228. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derby. Improvements in machinery and apparatus for the preparation and manufacture of iron and steel.

1232. F. G. Spilsbury and F. W. Emerson, Stratford, chemists. Improvements in the treatment of fusel oil, and for various applications of the same to useful purposes.

1234. H. W. Hart, Higher Broughton, Manchester, engineer. Improvements in the manufacture of reflectors and shades for gas and other lights.

1236. G. H. Smith, North Perrot, Somerset, twine and web manufacturer. Improvements in the manufacture of crinoline or elastic hoops for dresses.

Dated April 28, 1862.

1242. J. Fletcher, Furnham-place, Southwork, engineer. Improvements in the apparatuses for treating saccharine liquids.

Dated April 29, 1862.

1250. S. W. Newington, Goudhurst, Kent, surgeon. Improved apparatus for letting off and stopping the flow of liquids from casks and vessels, such apparatus forming a tap, and substitute for the ordinary vent peg.

1254. R. Bright, Bruton-street, Westminster, lamp manufacturer. Improvements in lamps and in apparatus for lighting Argand and other wicked lamps.

1256. W. L. Tizard, Mark-lane, engineer. Improvements in heating, cooling, and condensing apparatuses.

1260. E. B. Wilson, 5 Parliament-street, Westminster, engineer. An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel.

1262. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the constuction of mowing and reaping machines. (A communication.)

Dated April 30, 1862.

1266. A. I. Mahon, 25 Leinster-square, Rathmines, Dublin, engineer. Improvements in projectiles.

1272. E. Leigh, Manchester, mechanical engineer. Improvements in the construction of ships and floating batteries, in mounting their guns, and in the application of steam power, parts of which improvements are also applicable to land batteries and forts.

1276. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in the construction of couches or settees for the purpose of sitting, lying, or reclining upon. (A communication.)

1280. J. L. Norton, Belle Sauvage-yard, Ludgate-hill. Improvements in apparatus for drying fibrous materials and yarns.

1284. H. Willis, Albany-street, Regent's-park, organ builder. Improvements in valves for the supply and discharge of gaseous bodies.

1286. W. T. Loy, Rood-lane, City. Improved machinery or apparatus for carding cotton and other fibrous substances of a similar character. (A communication.)

Dated May 1, 1862.

1288. W. B. Smith, Camborne, Cornwall, merchant, and W. Bennets, Tucking Mill, Cornwall, engineer. Improvements in the method of, and apparatus for, preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases which escape from stacks, chimneys, calcining houses, chemical and other furnaces.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

1308. J. Tyler, 5 Kennington-place, Kennington-lane, professor of music. Improvements in the manufacture of clarionets. Dated May 3, 1862.

1333. F. Marrel, Marseille, France, iron master. Improvements in forming wrought iron bars for the manufacture of armour plates and other articles of forged iron. Dated May 5, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

3266. F. Tolhausen. Covering springs. (A communication.)

2. N. C. Szerelmey. manufacture of leather cloth.

3. J. H. Johnson. Pipe joints or couplings. (A communication.)

5. J. Walker. Forts and fortifications.

14. E. P. Davis. Gas burners.

25. G. Stracey. Artificial fuel.

26. F. S. Belloche and H. Bullack. Parasol.

28. J. W. Arundell. Treating and dressing ores and minerals. (A communication.)

31. C. Cross and E. Padmore. Manufacture of pile fabrics.

33. G. Leyshon and D. Beckley. Breaks.

34. J. Howden. Engines and boilers.

39. A. V. Newton. Manufacture of cigars. (A communication.)

40. G. Betjemann, G. W. Betjemann, and J. Betjemann. Dressing cases.

41. F. Brown. Kitchen ranges.

48. A. Wallis and C. Haslam. Rotary screws.

55. J. Stenhouse. Rendering certain substances less pervious to air and liquids.

63. D. Wilson. Preparing coffee.

65. D. Wilson. Hydraulic presses.

72. R. Johnson. Composition for coating the bottoms of iron ships.

83. J. White. Oil cans.

94. R. A. Brooman. Dished articles and cases. (A communication.)

102. E. W. Hughes. Malleable cylinders.

118. J. A. Knight. Dressing mill-stones. (A communication.)

125. J. M. Rowan. Steam hammers.

129. R. Romaine. Cultivating land.

140. W. S. Mappin. Improved lock.

150. J. Stenhouse. Protection of metallic surfaces.

153. C. Binks. Generating steam.

156. G. T. Bousfield. Nails and spikes. (A communication.)

182. J. Higgin. Retarding and stopping railway carriages.

183. J. Cornforth and B. Smith. Boring or drilling gun barrels and tubes.

218. M. A. F. Mennons. Engines actuated by heated air, or by combinations of air and steam. (A communication.)

230. W. Clark. Mechanical wrenches. (A communication.)

276. T. Cook. Punching, cutting, and pressing metals and other materials.

279. W. Clark. Manufacture of festooned edging or material. (A communication.)

281. M. A. F. Mennons. Recovery of the oleic acid. (A communication.)

291. C. M. Rouillier. Straps, bands, and chains.

331. J. J. McComb. Bales or packages.

378. M. A. F. Mennons. Disinfection of animal excretions. (A communication.)

403. T. Renison. Water closets.

462. J. Standish and J. Gooden. Carding engines.

573. P. Remond. Double rein bridle bits.

611. W. Parker and G. H. Batman. Steam engines.

755. J. A. Jaques, J. A. Fanshawe, and F. Jaques. Elastic surface rollers.

810. T. White. Nut and lobster crackers.

818. M. A. F. Mennons. Stitching or embroidery. (A communication.)

914. J. H. Johnson. Spinning fibrous substances. (A communication.)

1151. J. Pickard and T. Morris. Prevention of smoke.

1173. G. Scoville. Pistons. (A communication.)

1308. J. Tyler. Clarinnets.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

LIST OF SEALED PATENTS.

Dated May 9, 1862.

2834. W. J. Hay.
2835. R. Bellis.
2836. J. Davidson.
2857. C. E. Wilson.
2859. F. Coney.
2860. R. A. Brooman.
2861. H. Bird.
2865. H. R. Fricker and J. Stanley.
2882. J. Booth, T. W. Chambers, and J. Chambers.
2894. F. C. Partoe.
2909. R. Harcourt.
3271. W. E. Newton.
66. J. H. Tatum and J. Williams.
380. W. Hewitt.
537. J. Tangye.
571. H. Bowen.
752. W. Teague.

Dated May 13, 1862.

2876. J. Spratt.
2885. E. D'Estanque.
2886. D. Stewart.
2887. R. T. Worton.
2888. J. Else and T. Godfrey.
2891. J. Hawkins.
2893. P. Andre, J. P. Pline-Faurie, and J. P. Richard.
2895. M. D. Rogers.
2896. R. A. Brooman.
2898. G. P. Bonnston, and M. G. Prodon.
2899. A. J. Mundella and W. Onion.
2901. L. Smith and M. Smith.
2903. T. Redwood.
2917. F. Pole.
2918. L. Thomas.
2931. A. F. Yarrow and J. B. Hilditch.
2935. T. W. Davenport and S. Cole.
2958. J. Wilcox.
2976. J. H. Johnson.
3031. W. E. Newton.
3161. A. V. Newton.
3227. G. H. Birkbeck.
35. H. D. Pochin.
398. W. Hensman and Hensman, jun.
603. W. E. Newton.
910. M. Henry.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1142. T. Jones.
1149. M. Henry.
1153. R. Pearsall.
1160. F. V. Hullow.
1229. R. Romaine.
1273. A. V. Newton.
1314. L. Farrent and Suhra.
1316. G. Hadfield.
1437. A. V. Newton.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1030. J. A. Williams.
1031. J. Bowron.
1044. D. Morrison.
1045. G. Taylor.
1057. J. Harris.
1071. J. Herdman.
1085. R. McConnel.
1091. R. S. Newall.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending May 10, 1862

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s	d		s	d		s	d		s	d		s	d		s	d
2355	0	11	2382	0	3	2390	0	10	2398	0	10	2406	0	3	[illegible]	[illegible]	[illegible]
2310	4	5	2383	0	3	2391	1	6	2399	0	3	2407	0	3	[illegible]	[illegible]	[illegible]
2376	0	3	2384	0	3	2392	0	6	2400	0	6	2408	0	3	[illegible]	[illegible]	[illegible]
2377	0	6	2385	0	3	2393	0	3	2401	0	3	2409	0	3	[illegible]	[illegible]	[illegible]
2378	0	6	2386	0	7	2394	0	3	2402	0	9	2410	0	3	[illegible]	[illegible]	[illegible]
2379	0	6	2387	0	10	2395	1	0	2403	0	3	2411	0	3	[illegible]	[illegible]	[illegible]
2380	0	10	2388	0	3	2396	0	3	2404	0	3	2412	0	3	[illegible]	[illegible]	[illegible]
2381	0	9	2389	0	3	2397	0	3	2405	0	7	2413	0	3	[illegible]	[illegible]	[illegible]

NOTE.—Specifications will be forwarded by post Great Seal Patent Office (publishing department eceipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made pay at the Post Office, High Holborn, to Mr. Bennet W croft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, May 15, 1862.

		£ s. d.		£ s. d.
IRON:				
Rails in Wales and North of England	pr. ton	5 0 0	to	[illegible]
Welsh Bars, in Wales	,,	5 5 0	,,	[illegible]
Staf. Bars, at the Works	,,	6 10 0	,,	[illegible]
,, Hoops	,,	7 10 0	,,	[illegible]
,, Sheets, Singles	,,	8 0 0	,,	[illegible]
,, Nail Rods	,,	5 15 0	,,	[illegible]
,, Boiler Plates	,,	8 0 0	,,	[illegible]
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 11 3	,,	[illegible]
Do. No. 1, Good Brands	,,	2 11 0	,,	[illegible]
Scotch Bars	,,	[illegible] 5 0	,,	[illegible]
Swedish Bars, in London	,,	10 10 0	,,	[illegible]
COPPER:				
Sheet and Sheathing	per lb.	0 0 11	,,	[illegible]
Tough Cake and Tile	pr. ton	93 0 0	,,	[illegible]
Best Selected	,,	101 0 0	,,	[illegible]
Australian	,,	99 0 0	,,	[illegible]
South American	,,	0 0 0	,,	[illegible]
Yellow Metal Sheathing	per lb.	0 0 9½	,,	[illegible]
STEEL:				
Swedish Keg	pr. ton	15 0 0	,,	[illegible]
,, Faggot	,,	16 0 0	,,	[illegible]
TIN:				
English, Block	p. cwt.	6 1 0	,,	[illegible]
,, Bar	,,	6 2 0	,,	[illegible]
Foreign, Banca	,,	6 4 0	,,	[illegible]
,, Straits	,,	6 7 0	,,	[illegible]
TINPLATES:				
Charcoal, I.C.	pr. box	1 4 6	,,	[illegible]
Coke, I.C.	,,	1 2 6	,,	[illegible]
LEAD:				
Pig, English	pr. ton	10 15 0	,,	[illegible]
,, Spanish	,,	19 0 0	,,	[illegible]
Common Sheet	,,	21 10 0		[illegible]
Tea ,, (Wimshurst's Patent) A special disct.	,,	35 0 0	,,	[illegible]
SPELTER:				
On the spot	,,	18 10 0	,,	[illegible]
For arrival	,,	18 5 0	,,	[illegible]
ZINC:				
English Sheet	,,	24 0 0	,,	[illegible]
QUICKSILVER	pr. btl.	7 0 0	,,	[illegible]

JAMES LAURIE, Metal Broker
50 King William Street, E.C.

Digitized by Google

THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 23, 1862.

INTERESTING TARGET TRIALS AT SHOEBURYNESS.

On Tuesday last, there was a large assemblage at Shoeburyness of notabilities of the Admiralty and War Departments—military and naval officers, shipbuilders, engineers, iron masters, and other persons interested in the construction of naval armour, to witness the trial of a target on a plan invented by Mr. I. D. A. Samuda, the eminent shipbuilder of Poplar.

It is described as having been constructed at the expense of Government by order of the Lords Commissioners of the Admiralty. Its dimensions are 20 by 10 feet; the armour plates 5 inches thick, with a skin 1 inch thick, and longitudinal ribs of 2½ inches thick. India rubber, ⅜th inch thick, is placed between the armour plates and skin, and between the bolt heads and ribs; and it is said by the inventor that "the armour enters into the con- "struction of the ship, and thus gives strength "to the fabric."

The Mechanics' Magazine, of the 21st of March, contains a description and diagram of Mr. Samuda's system of armour-plating, as well as an opinion of its defective powers of resistance to artillery, in the following terms:—"This mode of structure is a system of panel- "ling, forming hollow spaces under the panels, "which, having no backing or support behind "to resist the impact of projectiles, will be "penetrated or driven inwards. The butts "will be forced outwards, and fractured at the "holding points, or tear away the bolts, which "are fastened round the edges. If the joint "receives the impact, the edges of the plates "will be fractured at the bolt-holes, or the "bolts will be broken off." The result of Tuesday's experiments has literally realized this opinion.

According to the established rule of the Iron Plate Committee, by whom the trial was conducted, the general stability of the structure was first tested by several hollow shot, some filled with sand, and some live shell, fired at 200 yards, which, to save repetition, it may be here mentioned, was the range of all the firing, and the same as that of the practice in previous experiments on the Warrior and other targets. Two rounds each of three 104-pounder shell, with 12 lbs. charge, and 49½-pounder shell from 68-pounder guns, with 16 lbs. charge, were fired, each shot singly. These projectiles, being broken up by impact against iron plates, have no penetrating force. Their invariable effect is to make indentations on the surface of the plate struck half to three-quarters of an inch in depth, and bulge it inwards, but without any or little damage to the iron. The dead heavy shock of the blow, however, tends to produce vibration if all the parts of the structure be not securely and tightly fastened together. Under this test the Warrior target stood better than any other; the Fairbairn lost nearly every bolt, of which the point and nut sheered off, and on this occasion the effect on the Samuda target was most disastrous. Only three bolts were broken off at the nuts, but several others started, and, probably, are broken. The heads of seven or eight riveted bolts were strained and cracked, and a great number of plate rivets sheered off as if cut with a chisel, two plates buckled half to one inch at the ends, and two frames, representing ribs of a ship, were cracked. The violent vibration, which caused so much injury, is no doubt to be attributed to the mistake Mr. Samuda made in placing a bed of india rubber (three-eighths of an inch thick) between the armour and the skin plates. The result was much the same as if a vacant space of that width had been left between the two plates, the effect of which, it must be apparent, would be that the armour plate receiving the shock of the projectile would be dashed against the skin and frames, and could not fail to damage them extensively. A shelf piece of great solidity, fixed inside and upon the frames to strengthen the structure, was nearly separated from its fastenings by the rivets sheering off. It became evident from these effects of hollow shot, Mr. Samuda's plan did not offer those conditions of strength which he had imagined, and its utter weakness was clearly demonstrated when the third round was fired. This consisted of one 140-pounder, charge 20 lbs., three 110-pounders, charge 14 lbs., and two 68 pounders, charge 16 lbs., all solid shot, and fired singly. They showed conclusively that the weak point of the system is the perforation of the plates with rivet and bolt holes close to their edges. The damage done by these six shots was greater than any effect produced at previous target trials. Six additional bolts were broken, a great number of skin rivets were torn away, two frames were broken completely in two, others were curved in and much damaged, one of the horizontal ribs, on which the inventor especially relied as a source of strength, was split across its width, and large pieces of the armour plate, five inches thick, were stove in at the joint where some of the projectiles struck. The precision of the firing, which planted the six shots within a space of 16 to 18 inches square, no doubt augmented the damaging effect, but still the inherent weakness of the system is too apparent from this trial to admit of any doubt.

As a final *coup de grace*, the 150-pounder Armstrong smooth-bore shunt gun, with a charge of 50lbs., was brought into action, and certainly no advocate of the "Gun *versus* Iron "Plates" could desire a more triumphant demonstration. The formidable missile, a solid 10-inch round shot, weighing 156lbs., which struck the joint of the middle and lower plates on the right of the port, went clean through the whole structure, penetrating the 5-inch plates as if they had been deal boards, leaving a hole bigger than a man's head, crushing through the rib plate, of which more than two feet were broken off, and tearing away and breaking up into splinters a piece of the skin plate measuring about 2 by 3 feet, of which fragments were carried 20 or 30 yards behind the target. It would be impossible to conceive a more damaging shot. The impression on most of the spectators was that no combination of iron plates could resist the 150 pounder Armstrong, but experienced observers of target trials came to the conclusion that the result simply proved the weakness of the resisting force, and the necessity for some system of backing which shall afford efficient support to the plates.

The Lords of the Admiralty, confident in the greater powers of resistance of the Warrior section, had a similar 150lb. shot, with the same charge, fired at a plate of that target, precisely in the same position as the plate so extensively damaged in the Samuda target. The projectile passed through the 4½ inch armour plate and buried itself in the teak backing, but it was stopped by the iron skin and did *no* damage inside. It must be admitted that up to this time the Warrior section has stood the brunt of the heaviest ordnance used in these target trials with the least damaging effect. But we must not lose sight of one serious objection to the Warrior system. If the wood backing protects the frame of the ship, it causes the destruction of the bolts. Of eleven bolts which fasten one plate, eight are visibly destroyed, and it is probable the other three are broken inside the wood. That plate has little hold, if any, on the ship, and in a rolling sea might become detached and fall overboard. With only one large plate gone the vessel would cease to be invulnerable. Shell as well as shot could be fired into her through the large aperture caused by the loss of a plate, and, practically, she would cease to be an armour-plated ship.

After the close of these experiments, an iron plate 7 feet by 3 feet and 4½ inches thick, manufactured at the Monkbridge Works at Leeds, was fired at to test the quality of the iron, which appears to have been considered satisfactory by the Iron Plate Committee.

We understand the experiments on Mr. Scott Russell's and other targets will be resumed in a few days.

FIRES IN LONDON.

The Select Committee, appointed some three months since by the House of Commons, to inquire into "the existing state of Legislation, "and of any existing arrangements for the "protection of life and property against fires "in the Metropolis," have completed their mission, and made their report. This has been published, and it may be well to investigate its averments. The alarming increase in the number of destructive fires in London during the last few years, and the apparently quite inadequate means possessed for their suppression, had, indeed, rendered legislative inquiry necessary. The Committee set out in their report with a statistical comparison of the number of fires in London in past years as compared with the number which occurred in 1861. For example, they state that in the year 1833, 458 fires occurred in the Metropolitan districts, whereas in the year 1861, the number was 1,183. So startling an augmentation forms of itself so severe a condemnation of the existing arrangements for the prevention of fires, that it needs no argument to sustain it. The area of the Metropolitan police districts includes, according to Sir Richard Mayne, 217 parishes, with a population of about 3,000,000, residing in 462,000 houses. The rateable income for taxation in the mammoth town and its immediate suburbs is about £13,500,000. The extent of space included in the calculation is bounded by a radial line of 16 miles, with Charing-cross for its centre, and this gives, therefore, an area of 700 square miles. The City of London, however, is not included, but within its boundaries are 97 parishes, with a population of about 115,000, inhabiting some 13,500 houses, and the rental for rating is £1,337,000. Thus it appears that the whole of the Metropolitan police districts, and the City of London together, may be considered as containing rather over 3,000,000 of inhabitants, in about 745,000 houses, whilst the rental for rating may be taken in round numbers to be £14,800,000.

These facts and figures convey a clear idea of the range and importance of the trust confided to those who are charged with the guardianship against the disastrous consequences of accidental or incendiary fires. The Committee state that "the only existing Act "of Parliament for the prevention of loss by "fire, affecting parishes within the bills of "mortality, is that of the 14 Geo. 3, c. 78, and "called 'an Act for the further and better regu- "'lation of buildings and party walls, and for "'the more effectually preventing mischief by

“ ‘fire within the Cities of London and Westminster, and other liberties thereof, and other the Parishes of St. Marylebone, Paddington, and St. Lukes, at Chelsea, in the county of Middlesex.’ ” The clauses in this Act, which relate especially to protection against fire, are those numbered from 74 to 86, both inclusive, and they are still in form. The other parts of this Act have been repeated. By the 76th clause, every parish is obliged to keep one large engine, and one small one, termed a hand-engine, besides a leathern pipe, and a certain number of ladders. A provision, moreover, exists in the 3 and 4 Will. IV., c. 90, 344, and known as the “Lighting and Watching Act.” This Act extends to England and Wales, and it empowers inspectors appointed under it to provide and keep up two fire-engines. Certain parishes, without the bills of mortality, have availed themselves of that provision. The meagreness of all these arrangements is sufficiently obvious, and, meagre as they are, they have not been attended to.

The Select Committee state—and it will conduce to a more exact understanding of the whole question if we reproduce the substance of their statement—that for many years previous to 1832, the principal fire insurance offices kept fire-brigades at their individual expense. To these brigades were attached a considerable number of men usually occupied as watermen on the Thames. These latter received payment only on the occurrence of fires, and they wore the badge and livery of the various companies by which they were subsidized. These fire-brigades were considered as giving notoriety to the different insurance companies, and a rivalry was maintained among them, productive of good sometimes, and considerable evil at others.

The expenses and inconvenience arising from this unsatisfactory state of affairs induced Mr. R. Bell Forde, a director of the Sun Fire Office, to make, in 1832, an effort to reform the system. This consisted principally in a proposition for the amalgamation of the guerilla bands—as they might be termed—into one body. Mr. Forde's plan was adopted, and hence sprang into existence the London Fire-Brigade. The leading Metropolitan insurance offices contributed their quota to the support of the brigadiers on conditions laid down by representative committeemen from the various companies. Without tracing the subsequent changes made in the mode of governing the London Fire-Brigade, it may be stated that at its organisation, in 1832, it consisted of 80 men, while the number of fire-stations was 19. The cost of the brigade and its appliances in that year was £8,000. This expense has been gradually increasing, as has the nominal strength of the body and the number of engines employed.

At present the London Fire-Brigade consists of 127 men, and the stations are 20 in number.

The destruction by fire of the Houses of Parliament, in 1834, very naturally drew the attention of the Government to the means for suppressing fires generally in London. It is only justice to the fire insurance companies then in existence to say that they admitted the inadequacy of their arrangements for preventing and overcoming fires. A suggestion was also made, at the same time, for placing the parochial engines under the control of the Metropolitan police. This latter notion might, if realised, have been attended with some good probably, but the Government of the day did not adopt it, and so the fire-brigade has remained with all its anomalies and shortcomings—as regards the system, we mean, upon which it was based—until now.

It is needless to recapitulate the arguments for the reconstruction of the London Fire Brigade which were energetically urged in the pages of this Magazine immediately after the great fire of last year, because that disastrous event, and the innumerable catastrophes of a similar though less ruinous kind, which have happened since, have demonstrated the absolute necessity for such change. But it is certainly refreshing and encouraging to find from the report now under notice that “the insurance companies addressed on the 21st of February last,” the very day after the first meeting of the Select Committe, “a letter to the Secretary of State for the Home Department, stating their wish and intention to give up the brigade at as early a date as may be consistent with the formation of new and efficient arrangements for the protection of the metropolis against fire.” They state in that communication that, “so long as the expense was moderate they did not object to incur it; but now it had assumed a magnitude which they cannot continue to bear, and that they consider that the public of London have no claim whatever on their respective offices for protection against fire.” It certainly was rather late in the day for the companies to admit their deficiencies, and show their readiness to abdicate their functions as the suppressors of London fires, but it is satisfactory to find them, at last, so completely in accord with the public sentiment. The fact of their being so renders legislation on the subject more facile, because now there are no dissentients to the needed reformation of the fire-brigade. The fact was, that the system, having outlived its time, its abolition will be hailed, by the vast and populous districts of the Metropolis, with real satisfaction.

There is no reason to doubt the efficiency of the staff comprising the Insurance Companies' Fire Brigade, so far as personal courage or determination is concerned. On the contrary, they appeared to have been well selected and trained, and in many instances their services have been of immense value. There is no reason, therefore, why officers and men should not be absorbed in the more extensive organisation which it may be trusted will presently be called into being to supplant it. Indeed, the Committee recommend some such step as this, and there can scarcely be any objection to offer to it.

There is much valuable evidence adduced in the report with regard to fires generally, and the means adopted in the large cities and towns of the kingdom for preventing and overcoming them. As respects large establishments in London, too, the committee have sought out and given to the public a considerable amount of useful information. The dock companies have taken especial care to make themselves to a great extent independent of extraneous aid in the suppression of fires which may break out on their premises. The East and West India Docks are particularly well cared for as touching this matter. So is the Royal Mint; and among private firms who have endeavoured to provide means, not only for the preservation of their own property, but of that of their neighbours too, we may mention Messrs. Brown, Lenox, and Co., of the Isle of Dogs, and Mr. Hodges, of the great distillery at Lambeth.

Honourable mention is made in the report of the “Society for the Protection of Life from Fire,” and undoubtedly that society has proved of inestimable value in many instances. It is just one of those institutions of which Englishmen may be legitimately proud, and of which we happily possess a considerable number. Supported purely by voluntary contributions, and having for its object the saving of human life, it is to the metropolis what the National Life Boat Institution is to the rock-bound coasts of England—a guardian and friend to those who are in imminent peril. No less than £7,000 per annum have been subscribed for the support of the Society for the Protection of Life from Fire for eighteen years, and this speaks eloquently of the benevolent disposition of our countrymen. Into the question of obtaining a more adequate and ready supply of water for the purpose of suppressing fires in the metropolis, it would be premature for us now to go. It is one which will have to be considered, nevertheless, in conjunction with that of the formation of the New Metropolitan Fire Brigade, and at the proper time we shall advance an opinion as to the best mode of effecting it. There are several other points connected with the Report of the Fire Committee which will be treated on in another article. We most cordially concur in the general conclusions of the Committee, which conclusions, indeed, embody the propositions offered last year in our own pages.* There are but three absolute and official recommendations offered to the House of Commons in the report, namely:—

“1. That a fire brigade be formed under the superintendence of the Commissioners of Police, on a scheme to be approved of by the Secretary of State for the Home Department, to form part of the general establishment of the Metropolitan Police, and that the acts requiring parishes to maintain engines be repealed.

“2. That an account of the expenditure of the New Police Fire Brigade be annually laid before Parliament, together with the general police accounts, in such a manner that the special cost of the brigade may be ascertained.

“3. That the area of the new fire brigade arrangements be confined within the limits of the Metropolitan Board of Works, with the option to other parishes to be included, if within the area of the Metropolitan Police.”

The policy of confining the action of the brigade to the limits named is not transparent; but it is only “recommended” that those limits be observed, and probably the House in its wisdom will extend them.

THE NAVAL ARMOUR QUESTION.

We have great satisfaction in announcing that the Admiralty officials have come under better counsel, and we believe the Mechanics' Magazine may claim some credit for the wholesome change that has taken place. The independent Committee of Investigation and Experiment on Naval Armour, of which we recommended the formation, is practically called into existence by a new organization of the Iron Plate Committee, and the additional element of iron ship-building science introduced into its composition by the appointment of Mr. Laird as one of its members. The well-merited eulogium passed by Lord Clarence Paget on Sir John D. Hay and his colleagues is an acknowledgment by the Admiralty of the obligation they are under to be guided by the reports of that Committee, and there is reason to hope that inventions of promise for improving the construction of iron clad ships will meet with that justice which has hitherto been denied to them. We are perfectly aware that the name of the plans proposed is legion, and we also

---

* Mechanics' Magazine, July 12th and 19th, 1861.

Digitized by Google

know they have been laboriously and carefully examined by the Committee, who out of many hundreds found only a few worthy of being recommended for trial. The Admiralty, actuated by influences which no man can understand, ignored these recommendations, and with strange inconsistency authorised a large expenditure for experiments on other plans not approved by the Committee. On this subject we are in possession of particulars which reflect no credit on certain Officials, but as we believe the state of things we have referred to no longer exists we abstain from comment. The defective character of the target experimented upon at Shoeburyness last Tuesday, and of another to be tried in a few days was known, and represented in the proper quarter, but without effect, before the targets were constructed. It is, however, understood that for the furture the Iron Plate Committee's reports will be respected by the Admiralty.

There has been a controversy in this journal with reference to a particular class of vessels proposed to be constructed partly of wood and partly of iron. The design, we are informed, will be reconsidered and thoroughly investigated before it is adopted to any greater extent than the construction of one model gun-boat.

On the subject of the Spithead Forts, we repeat our warning to members of the House of Commons to be vigilant, and especially to bear in mind the analogy pointed out in the last Magazine between the proposed Forts and those on the Mississipi, which defend the approach to New Orleans, as illustrated by the surrender of that city to a few federal gun-boats. Forts Jackson and St. Phillip proved to be of no avail to prevent the passage of the enemy's flotilla.

Immediately after the appearance of our article on this subject, the *Times* adopted our view of the case; but it attempted to attenuate the force of the practical illustration it affords of the inutility of advanced forts as harbour defences, by adverting to the possibility of the construction of guns of enormous power and weight which might be mounted on Land Forts, but could not be used as the armament of floating batteries. Now, this idea is a delusion, which requires to be exposed. Iron-cased vessels intended for the protection of coasts and rivers, can be constructed of such strength and stability by giving them sufficient breadth of beam, that they would carry the largest guns that could be invented. In considering this matter, we have for our guide the structure of mortar boats, which affords an example of solidity opposed to the tremendous recoil of vertical firing, calculated to resist a greater shock and concussion than the heaviest ordnance would cause by horizontal firing. This question, along with others to which we have for some time past directed the attention of the public, requires to be thoroughly investigated by a Naval Armour Committee.

THE INTERNATIONAL EXHIBITION.

THE WESTERN ANNEX.

CONTINUING our examination of the contents of this branch of the Industrial Exhibition, which forms the most striking "trophy" of mechanical art, that could by any possibility be devised, we come now to a consideration of some of the manufacturing machines and tools therein. Cotton spinning machinery is largely represented, and Messrs. Dobson and Barlow, of Bolton, contribute a fair quota of the whole. They exhibit, in fact, a series of machines for opening and cleansing, preparing, and spinning cotton. The whole of these are replete with the most modern improvements of detail, and they may be briefly mentioned in the order in which the operations named follow each other in ordinary working. The first is named a cotton spinner, and it is adapted for spinning and cleaning long or short shaped cotton. The feeding parts and the inside gratings, are of a novel construction, the object in view being to open out and clean the cotton without injuring the staple. The second is called the single scutcher, and it is supplied with feeding rolls, which have been patented by the firm in question. The merit of the rolls consists in their holding the cotton sufficiently firm without breaking the seeds or shells. Then follows the breaker carding-engine, which is a combined patent machine; Wallman, of the United States of America, and Dobson and Barlow, each having a hand in it. Its chief merits are that the cotton is well opened and cleaned by the working rollers, before the upper rollers will allow it to pass the self-stripping top flats. These flats can be taken out at pleasure by the attendant, and re-adjusted without the use of a screw key. A finisher carding-engine stands next, and it works automatically—an improvement on the plan of stripping flats by hand as is usually done. Ashworth's patent lap machine is used for making laps for the finisher carding-engine, and combing machine, and a grinding apparatus is so contrived as to grind two rollers and a flat at the same time.

Then follow five frames, known respectively as the drawing frames, with forty-four spindles, each ten inches by five inches; the intermediate frame with fifty-four spindles, each eight inches by four inches; the roving frame of seventy spindles, each seven inches by three and a-half; and the jack frame of eighty-eight spindles, five inches by two and a half.

The patent self-acting mule, of Dobson and Barlow, makes the total of the cotton-spinning arrangements at the exhibition of that firm. This last presents numerous peculiarities, and the whole of the machines are well fitted up.

Platt, Brothers, and Co., of Oldham, figure most extensively in the same branch of manufacturing industry, the space devoted to their machines and contrivances being very large. As the Illustrated Catalogue, Part III, however, does elaborate justice to their cotton-working machinery, we need not further refer to it than to say it reflects the highest credit upon the firm, who must have gone to very great expense in forwarding the whole to London, and keeping a large staff of workmen and girls to attend to it.

The cotton machinery of Messrs. Hetherington, of Vulcan Works, Manchester, is not inferior in many parts to that we have already referred to, and, indeed, it will not be the fault of the great firms of the Midland districts if visitors to the International Exhibition do not gather much valuable information as to the treatment of that vital element of industrial labour—cotton.

The paper-making and paper-cutting machines of Messrs. Bryan, Donkin, and Co., of Bermondsey, are suggestive of the immense consequence of the material with which those machines have to deal. This firm have earned a well-established reputation for the excellence of their paper-making and dressing machinery, and the gigantic well-finished specimens of their work in the Western Annex prove that they are likely to maintain their fame.

The Western Annex is, as we stated on a former occasion, extremely rich in specimens of engineering tools, and, perhaps, in this respect Messrs. P. Fairbairn and Co., of Leeds, make as distinguished a show as any. The radial drilling machines exhibited by this firm are excellent specimens of their productions in the tool department, and their universality of application must make them invaluable in the erecting shops of the engineer and millwright. Of lathes, planing, and slotting machinery, too, they contribute excellent examples.

In engineering tools of a, generally speaking, less massive kind than those of many of his neighbours, Mr. Whitworth, of Manchester, is largely represented. His lathes, which are so generally used by engineers, not only at home, but abroad, are to be found in every variety at the Exhibition. There are numerous specimens, also, of drilling and slotting machines, all of which are distinguished by the excellence and exactitude of fitting, which have obtained for Mr. Whitworth a world-wide fame. The wheel-cutting machine exhibited calls for especial remark. Those who are aware of the tediousness which attended the operation of chipping and trimming wheels by hand, and the chances which there were, after all, of the teeth being out of pitch, cannot but appreciate the value of this contrivance. It may be made to deal with either metal or wood, and with both spur and bevel gearing. It will cut the teeth or cogs of wheels up to ten feet diameter, and those of pinions down to the smallest size and pitch, and with the certainty of truth and uniformity.

We spoke but now of the importance of paper; and nearly allied to it in that importance is printing. Messrs. Petter and Galpin give us, in the Western Annex, an excellent example of what has been done in the shape of printing machines, and an idea of what may be expected; but it remained for "The Type Composing and Distributing Machine Company" to furnish visitors to the Exhibition with an apparatus intended for facilitating the work of the compositor.

The machines shown are the invention of the late Mr. James Hadden Young; and, as a plea for their use, we are told that while printing from the composing types has, by the improvements in the steam press, been carried to a most advanced stage, yet that setting up by hand is not done more quickly than it was 400 years ago, by the earliest printers. This certainly developes a *prima facia* case for stimulating the creative powers of mechanical inventors; but we are not quite prepared to say that the machines in the Annex are successful exemplifications of inventors' powers in this direction.

A suppositious state of things has been assumed, with a view of setting forth more clearly the inestimable value of the type-composing and distributing machine, and it is this: Let it be imagined that half an hour before the usual time of putting to press, news arrives, at the office of a daily journal, which would extend in the telling over three of its columns. This would involve the setting of something like 45,000 types, and in order to accomplish it a staff of ninety compositors would have to be employed. Each of them would have a scrap of paper put into his hand to set up in such a manner that it may tally with his neighbour's piece, technically called "making even." This would, undoubtedly, be a heavy piece of work, and one in the execution of which errors would be likely to creep in. Well, if all be true that is told of the machines named, they would make very light work of it. With them the task would be accomplished by six "players," and twenty-two justifiers in the same time, and only six pieces of copy instead of ninety would be required. The chances of error thus would be considerably lessened.

The type-composing machine is provided, something after the manner of a pianoforte, with separate keys for all the letters of a fount. This admits of each letter being set up in the

Digitized by Google

order required by the compositor's copy, with a speed which is only limited by the eye and fingers of the player. The art of playing the machine, or as we should prefer terming it, working it, is said to be acquirable by a compositor, with the short noviciate of a few weeks' practice.

As the type-composing machine sets up the type in long lines, Mr. Young invented his "justifying apparatus," which is intended to replace the compositor's stick, an implement it, however, resembles. This is fixed to a frame, and is used as follows:—The compositor places the galley filled with the long lines set up at the composing machine. He fixes one of these lines into the apparatus, divides it into the proper length, reads it, makes corrections, and having justified it, he moves a handle, by which the completed line is depressed, and room is made for a succeeding line. It is found that a skilful compositor can justify at the rate of 4,000 types per hour.

As we have said, the whole of the arrangements, connected with their adjuncts to the printing office, are ingenious, as are the calculations and theories suggested. They do not as yet, however, fulfil all the conditions required in practice, and hand labour in this department of industrial art may be said to hold its own.

Sewing-machines of divers forms, and with little peculiarities, which go to make up a considerable amount of difference, are to be found in the Western Annex. These remarkable domestic appliances have been so minutely described in the Mechanics' Magazine in time past, that we need not dwell upon them now. There is no doubt that they are working out a social revolution not only in this country, but throughout the civilised world, and it would have been unpardonable to have omitted altogether noticing the specimens exhibited at Kensington. Messrs. Newton Wilson, and Co. are the largest exhibitors, and among the ponderous and massive mechanical appliances by which the sewing-machines are surrounded, perhaps there are none which are, morally speaking, more powerful.*

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER XIII.

REED'S WOOD AND IRON SHIPS.

In a foot note to my last letter, mindful of Mr. Reed's former able advocacy of iron as the only suitable material for the construction of ships of war, you suggested that to designate him as an advocate of wood was a misrepresentation on my part. But one word will set me right with your readers. I would not misrepresent any man, and I have not done so in this case. Your note refers to what Mr. Reed *was*, I describe what he *is*, and so long as he supports a plan for the construction of vessels with *wooden bottoms*, he will practically be the advocate of wood. His misplaced sarcasm on the eminent iron ship builders of the Clyde, the Tyne, and the Thames, in calling them "men of iron at any price," substituting *wood* for *iron* recoils upon himself. I am sorry you remind me that Mr Reed was at one time the advocate of iron, for it obliges me to state that on several occasions articles from the pen of Mr. Reed, or of which he was believed to be the author, and written with great ability and soundness of argument, were published in the Mechanics' Magazine to prove that our ships of war ought to be built of iron; showing that in point of strength and speed, economy and durability, vessels of that material were far superior to wooden vessels. I am compelled, therefore, to conclude that Mr. Reed either is a renegade to his former belief in iron or a sincere convert to the cause of wood. I leave him to make his choice, but in either case I am justified in designating him at the present time as the advocate of wood.

Be that as it may, I am able to announce from an authentic source of information that the "Enterprise" scheme, as originally propounded, is nipped in the bud. Wooden bottoms are at a discount and iron is again in the ascendant. The latitude afforded in your columns for the ventilation of that question, has produced a salutary effect. Some influential members of Parliament have not been deaf to the appeal addressed to them, and it is felt in official quarters that the attempt to smuggle through the controller's department the wholesale construction of a timber fleet would be a hazardous enterprise. The announcement in Parliament that Mr. Laird, M.P. for Birkenhead, is appointed a member of the Iron Plate Committee, and is especially requested by the Admiralty to "report on the facilities for coppering the bottoms "of iron vessels," is a significant hint that the surreptitious attempts to restore the reign of wood has little chance of success.

A Civilian.

UNIFORM WEIGHTS AND MEASURES.

Under the auspicies of the International Association for obtaining a Uniform Decimal System of Measures, Weights, and Coins, a collection of the weights of the various countries of the world has been made, and these will form part of the curiosities of the International Exhibition. Few persons are aware of the extraordinary diversities in weights and measures which exist in our own country. The price of corn, for instance, will be quoted in at least fifteen different ways, in as many different localities; at so much per cwt., per barrel, per quarter, per bushel, per load, per weight, per boie, per bag, per coomb, per hobbet, per winch. per windle, per measure, per strike, per stone. The word bushel is in some places used for a measure, in others for a weight, and this weight is by no means the same in all places. In different towns of England the bushel means 168lbs., 73½lbs., 62lbs., 80lbs., 75lbs., 72lbs., 70lbs., 65lbs., 64lbs., 63lbs., 5 quarters, 14½ quarts, 488lbs.; and in Manchester, while a bushel of wheat is 60lbs., a bushel of American wheat is 70lbs. The measuring of a stone is almost equally various. An acre of land expresses seven different quantities. These variations are highly inconvenient and prejudicial to the transactions of trade; and the labours of the above-named association are directed to the bringing about a uniformity, of which there is great need. The metrical system employed in France is that which is advocated. This has been already established in Belgium, Holland, Sardinia, Lombardy, Greece, Spain, Portugal, and many other parts of the world. Great Britain, and the American States, however, still adhere to their old systems.

It may be trusted that our legislation will ere long look this matter boldly in the face, and at a single stroke abolish the inconveniences, absurdities, and annoyances contingent upon the anomalous state of things which at present obtains. The decimalization of weights, measures, and money, is a thing which would immortalize the names of any government accomplishing it, and confer on the British public a boon which they would know how to appreciate.

THE TELEGRAPH IN AUSTRALIA.

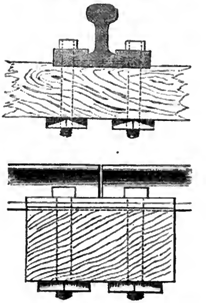
In Australia the telegraphic system is being extended with considerable rapidity. Contracts for five new and important lines have been recently let, and the works in connection with them are in hand. The longest of these is that from Orange to Wagga Wagga, and which will connect Sydney with the Lachlan and Burrangong diggings. It will also by being connected at Wagga Wagga with other lines afford a second line, connecting Molbourne with Sydney. Its estimated length is 250 miles, and it has been contracted for at £43 per mile. Mr. R. Rush is the contractor, and the time allowed him for the completion of the work is eight months.

The next longest line will be that from Grafton to Tenterfield, and this will connect the Clarence district with Queensland. This extension has been taken in hand by Mr. M. Favieli at £39 per mile. Its length is 125 miles, and six months are allowed for completing it.

An extension of the Southern line from Campbelltown to Wollongong and Kiama has been contracted for by Mr. Monk, at £38 per mile. It will be 64 miles long, and four months is the time given for executing it.

The fourth line is that from Mudgee to Wittington, a distance of 60 miles. It is let at £43 per mile. A short line from Muswellbrook to Scone—12 miles has been undertaken by Mr. Rush at £20 per mile. The posts in this case are already erected, and hence the smallness of the mileage charge.

PRICE'S INVENTION FOR SECURING RAILS ON RAILWAYS.



This invention, patented by Mr. J. Price, of Dunkalk, Ireland, relates to a peculiar system or mode of forming the joints of ordinary bridge rails or other flat-bottomed rails employed on railways, applicable either to new lines or to existing lines where such rails are employed.

According to this invention, it is proposed, in forming the joints of bridge or flat-bottomed rails, to employ a wrought-iron chair of a sufficient width to contain the flanges of the rail, and to receive the fastening bolts which secure the chair to the sleeper, as represented in the engraving, such bolts passing through the chair, but not through the flanges of the rail, the edges of which they touch or nearly touch when in their places. The actual bearing portion of the chair beneath the rail joint is in the form of a flat plate, and the portions which extend laterally beyond the flanges are thicker than the central portion by the thickness of the flange of the rail, which is thus held in a species of a flat trough. A washer plate is laid upon each side of the chair, and projects some distance over the rail flanges at the joint or abutting ends of the rails, so that the bolts which are passed through these plates and through the chairs will, when screwed up tight, compress the washer plate firmly down upon the rail flanges, and thereby hold the rail ends securely in their places. The same chair may be used on the sleepers next the joints of a road formed of fish-jointed flat-bottomed rails. By causing the bolts to pass through the chair only and not through the rail flanges, they may be considerably thicker than those hitherto used, which passed through the flanges, and tended to weaken the rail by reason of the necessity of having bolt holes drilled through the flanges.

---

* An unfortunate error, in respect to the dimensions of the cylinder of the Achilles, as exhibited by Messrs. John Penn and Sons, crept into our last week's notice; the real diameter of that noble casting is 112 inches.

Another improvement in the joints of bridge rails, and which may be used either separately or in combination with the arrangement above described, consists in the use of a dowel of compressed or uncompressed wood, which is driven tightly into the hollow of the rails at the joints, half the dowel being enclosed in each rail. These dowels may or may not be covered on the upper surface and sides with a plate of sheet iron, bent to fit the interior or hollow portion of the rails. The advantages derived from the use of these modes of forming the joints of bridge rails are facility for using much stronger bolts than heretofore, without any of the disadvantages attendant upon the present small bolts which pass through the rail flanges, and are not sufficient to hold down the rail, and wear out rapidly, whilst they, at the same time, tend to injure the ends of the rails, and to cut up the joint sleepers by allowing vertical and lateral motion.

Another advantage is the complete freedom of longitudinal motion allowed to the rails when under the influence of expansion and contraction, whilst the bearing of the chair, by reason of its width, is much greater, and, consequently, the sleepers are less liable to injury by the cutting of the chair into them. Sleepers that would otherwise be cast can be used for some years longer by laying these chairs.

Another advantage is that they can be applied to an existing permanent way, without any boring or notching of the rails, by simply widening the groove of the joint sleepers and boring new holes for the bolts in the sleepers.

ON THE PRACTICAL LIMITS OF ECONOMY FROM THE EXPANSIVE USE OF STEAM.

From the *Journal of the Franklin Institute.*

(*Concluded from page* 322.)

Without taking into account the power consumed in engine resistance, the following results were obtained :—

Points of cut-off	11/11	7/10	½	3/10	¼	⅕	1/10
Economic result	1·000	0·889	0·839	0·912	0·906	0·967	1·086

It is apparent that an increase of boiler pressure would modify this comparison, because the back pressure remains the same, while the mean pressure is decreased with increasing rates of expansion; consequently acting more injuriously on the nett power at higher rates. To show, however, that modification from this cause is not great, the following table gives the comparison of different rates of expansion, without allowing for any back pressure :—

Point of cut-off	11/11	7/10	½	3/10	¼	⅕	1/10
Economic result	1·000	0·882	0·840	0·874	0·852	0·877	0·915

When the effect of engine resistance equal to 1·7 pounds per square inch, as well as back pressure, is taken into account, the results are as follows :—

Point of cut-off	11/11	7/10	½	3/10	¼	⅕	1/10
Economic result	1·000	0·896	0·877	0·949	0·962	1·063	1·292

This table contains the *substance* of the whole set of trials. For as no engine can work without back pressure and its own resistance, it is the nett power, after deducting these two resistances, which must be compared. The amount (ascertained by experiment) for the latter of these elements is low, and shows the engine to have been in good condition; it generally varies in well designed engines from 1·5 to 2·5 pounds.

It thus appears that the most economical point of cut off is ½, then 7/10, 3/10, ¼, 11/11, ⅕, 1/10.

Those who find it difficult to accord these apparently extraordinary results with what they have observed in practice, overlook the fact that their observations have been made on the *same* engine, whereby they have ignored the modifying effect which would have resulted from the employment of a properly proportioned cylinder; *i. e.*, a cylinder of such size as would preserve the mean pressure the same.

The following table gives these proportions :—

Point of cut-off...	9/10	8/10	7/10	6/10	5/10	4/10	3/10	2/10	¼	⅕
Size of cylinder ..	1·000	1·010	1·032	1·115	1·207	1·339	1·613	2·160	2·491	3·181

It is calculated for an initial pressure 30 pounds above the atmosphere, 3 pounds back pressure, 2·1 pounds engine resistance.

To show that this change does produce an important effect on economic results, the following calculations are here introduced :—

Suppose an engine of 60 ins. diameter of cylinder, 3 feet stroke, with clearance space equalling 3 ins. of stroke, in which steam of 30 pounds (above atmosphere) is cut off at 3-10 stroke, back and engine resistance as above.

Steam consumed each half revolution.

ft. × 3-10 = 0·90 ft. + 0·25 clearance = 1·15 feet.
Area 2827 sq. in. = 19·63 sq. ft. × 1·15 = 22·574 cub. ft. of a density 613·6 gives ·03679 cu. ft. water used.

Power developed.

2827 × 44·7 total press. × ·662 coeff. = 83650·93
Less back pressure 3·0
And engine resistance 2·1
2827 × 5·1 = 14417·70
Nett pressure 69233·23 lbs.
And 69233·23 × 3 feet stroke = 207699·69 ft. lbs. exerted each half revol

If now the same cylinder be used cutting off at 7-10, the steam consumed will be—
3 ft. × 7-10 = 2·10 + 0·25 = 2·35 × 19·63 = 46·130 cub. ft.

Power developed will be—

Back and engine resistance as before 14417·70
Nett pressure 69233·23
Gross pressure 83650·93 ÷ 2827 = 29·59 pounds.
Coeff. of 7-10 = ·951, therefore $\frac{29\cdot59}{\cdot951}$ = 31·11 initial pressure,
of which density is 854·5.
Hence the water used will be $\frac{46\cdot130}{854\cdot5}$ = ·05397 cub. ft.

Comparing these two results from the same cylinder,
Cutting off at 3-10 steam consumed 0 3679 or 1·000 to
" " 7-10 " " ·05397 1·467
the same nett power being produced.

But suppose the cylinder diminished so that the same pressure may be maintained equal 30 pounds until cut off at 7-10 stroke.

Power (nett) as before = 69233·23 obtained with
steam, initial pressure, { 30·00 / 44·70 total } cut of at 7-10, coeff. = ·951 = 42·51
Less back pressure and engine resistance = 5·10
Nett pressure throughout stroke, in pounds per square inch, 37·41
Area of cylinder = $\frac{69233\cdot23}{37\cdot41}$ = 1850 sq. ins. = 48½ ins. dia.

Steam consumed.

3 ft. × 7-10 = 2·10 + 0·25 = 2·35.
Area 1850 sq. ins. = 12·84 × 2·35 = 30·174 cub. ft. of a density = 613.6 or ·04917 cub. ft. of water.

Comparing this result with that from the larger cylinder, we see that the ratio between 3-10 cut off there and 7-10 here is
With large cylinder cutting of at 3·10 ·03679 or 1·000 to
With small " " 7-10 ·04917 13·36,

The advantage of using the proper size of cylinder in this case, to obtain the same power, is as
14 67 to 13·36, the difference, on the unit of power with high expansion, being over 13 per cent. !

This it will be remembered is purely the result of loss by clearance, back pressure, and engine resistance. To reconcile the theoretical economy still existing, with the observed results, we must refer to the other sources of loss referred to earlier in this paper. When it is remembered that the internal and external surface is one-third greater, that the terminal pressure is less than one-half, that the terminal temperature is reduced from 233° to 196°, that expansion (involving condensation) is carried to double the extent, on three-fourths the weight of steam, or to one-half greater extent on the same weight, in the larger cylinder, it will be less difficult to reconcile the theory and the results.

Add to these considerations, that we have an engine to build and preserve in good condition, which will not cost over 80 per cent. that of the larger one, of a simpler character, of less weight, and occupying less space, and we are more disposed to accept the results than the theory.

At all events, if these arguments possess any weight, it would seem that the suggestion made by the Board as a result of the Erie Experiments, to wit, that for general purposes rotating engines should be designed for a maximum resistance requiring steam to be cut off at 7/10 stroke, is practically a tenable position. The link motion, or some simple valve gear, would enable this cut-off to be shortened to ½ stroke, with an economy nearly the same as if that had been the normal point of cut-off intended.

The advantages to be derived from complicated mechanism for expansion gear, to obtain "sharp corners" on the cards, and for varying the cut-off from nothing up to full stroke, are rendered by such an argument exceedingly mythical.

Not that they may not produce benefit when applied to any given engine already in use for doing a certain work, which has been designed too large for that work; but that *better* results might be obtained by proper proportions in engines designed on the basis indicated.

It is, from the foregoing, evident that the labours of the Erie Board cannot greatly modify existing practice; but I am disposed to think they will in time modify existing ideas, which will hereafter produce their proper fruit.
J. V. M.

Philadelphia, March, 1862.

Lighthouses in the Red Sea.—"The works for the execution of lighthouses in the Red Sea," says the *Moniteur de la Flotte*, "are being executed with rapidity. The Zafarana, situated in the Gulf of Suez, has been lighted since the beginning of January, and the Ushruffee, which is placed in the Jubal Strait, and the Dedaley on the rock of that name in the middle of the Red Sea, will be in use before the end of the present year. Those three lighthouses belong to Egypt, and are maintained at the expense of the Egyptian Government. The Peninsular and Oriental Steamboat Company has undertaken to deliver by its vessels in passing the oil for lighting, and the necessary provisions for keepers."

THOMPSON AND STATHER'S HYDRAULC PRESS.

Fig. 1.

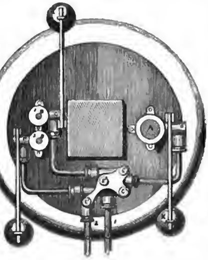
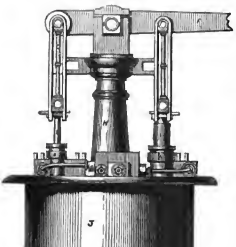


Fig. 2.



This invention, just patented by Messrs. Thompson and Stather, of Hull, relates to those presses in which one large and two small pumps are employed for working a pair of presses or double press, and consists in fitting stop valves commanded by handles accessible to the attendant, whereby communication can be opened with both or either of the presses as required.

Fig. 1 of the accompanying engravings is a plan, and Fig. 2 a side elevation of a hydraulic press fitted in this manner.

A is the large pump; B^1 and B^2 are the small pumps; C^1 is the stop valve for the large pump to the press pipe D^1; C^2 is the stop valve for the large pump to the press pipe D^2; E^1 is the stop valve from the small pump B^1 to the press pipe D^1; E^2 is the stop valve from the small pump B^2 to the press pipe D^2; *F* is the lever for working the pumps; *G G* are the links; *H* is the pillar or stand, and *I I* are the pump rams; *J* is the cistern; *K K* are weights on the valves; *L* is the cross head, and *M* is a guide. The pump B^1 has no connection with the stop valve E^2, nor with the press pipe D^2; each small pump has its separate stop valve and press pipe. The large pump has two stop valves, so that it may act with either of the small pumps as may be required. All the stop valves have separate handles, and are entirely under the control of the pressman.

HUGHES' HIGH PRESSURE TAP FOR STEAM.

Fig. 1.

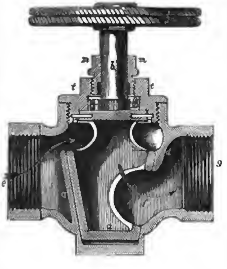
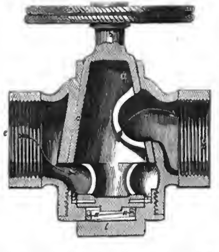


Fig 2



These improvements in taps, patented by Mr. Thomas Hughes, of Birmingham, whether used for regulating the flow or the drawing off of fluids, are applicable for general use, but more particularly for high-pressure purposes, whether for steam, water, or other fluids. The invention consists in making the plug taper and hollow, so as to permit the fluid under all circumstances to enter the interior of the plug, and by its force being exerted in all directions equally, the plug will not be liable to be tightened by the pressure of the fluid, or to work loose. To effect this object a number of radial holes or apertures are formed around the top or enlarged part of the plug opposite the flow way into the plug, and at the lower or small end of the plug only one hole or flow way, which being turned opposite the nose or front flow way of the tap premits the fluid to escape, or to be drawn off, or to flow through, as required. The plug may be retained in the body or barrel of the tap by a washer and screw at its smaller or lower end, or by a collar surrounding the neck of the plug at the top, screwed or otherwise secured to the body of the tap, or otherwise, as may be preferred. according to the purpose, or shape, or design in which such taps or cocks may be required to be made.

Fig. 1 of the accompanyings engraving is a vertical section of one form of tap. *a* is the plug of the tap connected to or formed in a piece with a stock or rod *b*, carrying a wheel or handle *c* for working the plug; *d* is the barrel in which the plug is free to move. The plug *a* is hollow, and has at its upper end radial openings or apertures, by which steam, water, or other fluid enters, and is in continual communication with the inlet *e*; *f* is an opening by which it passes (as hereafter stated) to the outlet *g*; a leather, caoutchouc, or other washer is inserted in an aperture formed in the upper end of the plug, bearing against a spring ring *i* below, and *k* is a spring above the plug; *l* is a stopper screwing into the top of the tap, and acting as a bearing surface for the rod *b* to work against; *m* is an ordinary stuffing box to be used in case of leakage. No matter what position the plug *a* occupies in the barrel *d*, it is always full of steam, water, or other fluid, but by giving the handle *c* a half turn to the right or left (supposing the outlet to be previously closed) the opening *f* is made to correspond with the outlet *g*, and allows the steam or other fluid to escape; a half turn in the contrary direction closes the passage *f*.

Fig. 2 is a vertical section of another form of tap, in which the position of the plug is reversed; here the stock or rod *b* is connected to the small end of the plug, and the radial openings are placed at the bottom instead of the top of the tap. The plug bears against a spring, and a screw stopper *l* keeps the whole compact. In other respects the tap is similar to that just described, and the same letters of reference indicate similar parts. It will be seen that the hollow plug is always in equilibrium, however great the pressure acting upon it may be.

NAVAL GUNS.

A most important discussion has taken place at the Royal United Service Institution, Whitehall Yard, in reference to the question of our naval armaments.

It arose out of a paper prepared by Capt. E. G. Fishbourne, R.N., C.B., "The Character of Gun best adapted for Naval Warfare, as gathered from the various plans of guns proposed."

The First Lord of the Admiralty, His Grace the Duke of Somerset, presided, and we have a pleasure in giving a *resume* of the arguments adduced, and the opinions entertained by the gentlemen who, on the three evenings during which the deliberations extended, addressed the meeting.

Captain Fishbourne, in his opening address, described, in singularly impartial terms, the result of his experience and that of his brother officers in reference to the Armstrong breech-loading naval guns, illustrating his various arguments by an elaborate series of tabulated results of ranges and initial velocities with every particular in reference to the weights of projectile and powder charge employed, and he gave the most unhesitating testimony of preference to the service 68-pounder smooth-bore gun as the one best adapted, from the high initial velocity of its projectile, to fulfil the modern requirements of naval warfare. He also adverted to the grave inconveniences arising from the use of lead-covered projectiles, and stated that for naval purposes they must be held as inadmissible.

At the conclusion of this paper, the Duke of Somerset addressed a few words to the meeting, shewing a sound appreciation of the real points at issue in this matter. He said the authorities were in doubt as to whether the naval gun of the future should be of cast or wrought-iron, or a combination of wrought and cast-iron, and whether the gun should load at the muzzle or at the breech, and he felt certain that a discussion of this character must place much valuable information at the disposition of the authorities.

After some irrelevant discussion on the part of some gentlemen,

Sir William Armstrong was called upon to reply to the paper. He stated that the number of figures adduced by Captain Fishbourne was so great that he did not feel prepared on that evening to make his reply; but promised at the next meeting to express his opinion.

Colonel Lefroy, R. A., then rose, and stated that he could not agree with the opinion expressed by

Captain Fishbourne, relative to the initial velocities of the service guns compared with that of Sir William Armstrong's rifled gun: for, said he, last week, at Shoeburyness, a 12-pounder Armstrong gun, loaded with 3 lbs. of powder, gave an initial velocity of 1,718 feet per second, the initial velocity of the 9-pounder brass gun being 1,670 feet; and he concluded by expressing an opinion that the gentlemen who advocated muzzle-loading guns had not the ball at their feet so completely as they imagined; for the Armstrong 100-pounder gun had resisted at the proof cell not only 100 rounds of proof, with service charges, but the same number of rounds with double charges of powder.

Captain Blakely furnished the meeting with the results of his strengthened cast-iron gun, producing copies of the report of the Spanish Government, and various interesting data in relation to the very extensive series of trials he had carried on. He afterwards called attention to the pamphlet published by Daniel Treadwell, of the United States, which appeared to sustain the statement made, that the method of making guns known as the coil system, was really invented by Mr. Treadwell, and subsequently adopted and used by Sir William Armstrong.

After a few questions on the prominent points of the paper of Captain Fishbourne addressed to the meeting by Colonel Wilford, R.A., the discussion was adjourned to the following evening.

On Tuesday, the 20th inst, Sir. William Armstrong first addressed the meeting, and examined *seriatim* the various tables of results furnished by Captain Fishbourne. He denied the accuracy of the American table of results, and his reply to the allegations of the weakness of his coil principle was very characteristic; it was to this effect, that it is all very well to say that it is weak, but it has proved itself to be the strongest form of making a gun. In fact he pooh-poohed the objections. He then explained his diagram, illustrating the great advantages of guns of large calibre for naval purposes, and concluded his observation by stating his opinion that it would be necessary to employ for such purposes the very heaviest and most powerful smooth bore muzzle-loading guns, at the same time not to wholly discard the rifle guns, owing to the very formidable nature of the elongated rifle shell.

Mr. Charles Lancaster next addressed the meeting, stating that he completely agreed with Captain Fishbourne in reference to the paramount importance of high initial velocities of projectiles, and stated in reference to the points raised by the Duke of Somerset that there could be no question of the great strength exhibited by the muzzle-loading wrought iron heavy guns lately manufactured by Sir W. Armstrong, but inasmuch as the proportion of the weight of gun to the unit of projectile must remain a constant irrespective of the material, it was a moot point whether a combination of cast and wrought iron of the same weight would not fulfil all the requirements of the service, and a very great saving of cost result. He referred to diagrams illustrating some important experiments with cast-iron guns so strengthened, by which 31 rounds of destructive proof had been attained at the proof butt at Woolwich in excess of any previously tried gun not wholly of wrought iron, and exemplified by another diagram further improvements, having for their object to remove a portion of the cast-iron casable and to substitute a wrought-iron casable, thus transferring the whole of the longitudinal strain resulting from the explosion of the charge to the wrought-iron exterior of the gun, and he anticipated that a gun so strengthened would resist 100 rounds of destructive proof.

He then examined the question, shall the guns be rifled or not? and elucidated the subject by reference to the results of the late Lord Herbert's competitive trial of the service 32-pounder gun, exhibiting diagrams of the method of rifling and projectile employed by the several competitors, and stated that the results appeared to show by the fact that on some plans the guns always burst under 50 rounds, others under 20, others again lasting 300 or 400, and some plans 1,000 rounds, the gun still being perfect.

If these results were given with cast-iron, the argument applied with the same force to wrought-iron; but one of the most valuable facts appeared to be, that in respect to lead-covered projectiles, if the lead was applied in a thin form to the exterior of the projectile, and any charge exceeding one-eighth employed, the lead melted and passed off in fumes, or remained in the interior of the bore. The experiments referred to by Col. Lefroy demonstrated this most clearly.

If, on the other hand, the lead was applied thickly, as in other systems, and a charge exceeding one-tenth used, cast-iron guns nearly invariably burst under 20 rounds, owing to the jamming of the lead at the base of the projectile.

In reference to the plans having iron shot with projections to fit into the grooves of the gun, this competitive trial has demonstrated that the edges of the grooves are invariably crushed after a certain number of rounds, and the gun destroyed.

He then stated that the question of giving to the rifled projectile the same initial velocity as the service projectile had not yet been tried with naval guns, and made reference to his prior correspondence with the Select Committee on this subject, which he felt to be of very great importance, and, in his opinion, perfectly practicable, and which, if carried out, would necessitate a fresh series of trials by the Iron Plate Committee.

He concluded his observations by demonstrating, from the results of the trials of his guns before the Lancaster Committee and from the official return of stores used at the seige of Sebastapol, that every description of the service ammunition could be employed with his system, some of the guns at Sebastapol having fired between 2,000 and 3,000 rounds. Finally he urged the necessity of adhering, in our future naval guns, to the same calibre as the service gun, characterizing the reduction of the bore of our present naval rifled guns as one of the most serious errors ever advised or carried out.

Colonel Wilford rose to say a few words corroborative of Mr. Lancaster's statement in reference to the use of service ammunition from the Lancaster gun, and he felt it is duty to do so, as he had himself been a member of the "Lancaster Committees."

Mr. Haddon then stated that he differed from Mr. Lancaster in respect to the possibility of strengthening cast iron guns, and he asked any gentleman to visit Woolwich Arsenal and satisfy himself, by personal inspection of the cast iron guns attempted to be strengthened, yet burst in proof. He produced for inspection, the impression of the vent of a cast iron gun, in which three flaws were beautifully shewn, and he urged that cast-iron guns always had yielded in that way, and always would. In reference to Mr. Lancaster's observations on the competitive trial, he thought it would have been much better if Mr. Lancaster had stated at once that it was his own gun that had withstood 1,000 rounds.

His (Mr. Haddon's) gun was still under trial, which necessarily took time to complete, and he concluded by a clear and able statement of the advantages which would arise, in his opinion, from the use of Mushet's steel as the material from which our future artillery should be constructed, giving the results of the trials at Woolwich of a small gun cast by Mr. Mushet and bored and completed in the Royal Arsenal, and a very interesting table of the relative strength of Mushet's metal compared with various descriptions of steel and wrought iron.

Mr. Bashley Britten then addressed the meeting, and produced a series of interesting drawings of the various kinds of shells used by him, and instituted a comparison between his gun and that of Sir William Armstrong, showing by calculation the pressure exerted on the interior of the gun under the two systems. He stated that with charges of 5 lbs., the cast-iron service 32-pounder had yielded results far exceeding his expectations, and concluded with a recapitulation of the results of his trials and the advantages to be anticipated from them.

On the 21st instant the debate was resumed, a paper being read by Mr. Scott, C.E., the precise purport of which we had some difficulty to catch. It appeared to be, however, as we understood it, an exposition of a series of elaborate tables illustrative of the value of the impact of the different projectiles, and different ranges, and varying velocities.

Captain Scott, R.N., then stated that he felt compelled from the direct allusion made by Mr. Lancaster to his plan, to dissent to the conclusion arrived at by that gentleman, which, if correct, would prove incontestibly that no plan but the oval was adapted for rifled cannon. He then pointed out the disadvantages, in his opinion, of Mr. Lancaster's plan, and asked if his guns had not failed at Sebastopol. He stated that a gun had burst at Shoeburyness, and had killed or mutilated three serjeants of artillery. He denied that the grooves of his two guns were crushed on the edges, as stated by Mr. Lancaster, and stated that Captain Blakely had examined and could testify that the grooves were in perfect condition, and that although both guns had burst, they had exhibited considerable endurance. He considered that it was possible to strengthen the 68-pounder gun with wrought-iron on Captain Blakely's plan, so as to be perfectly safe with 20 lb. charges, and he finally referred to his many years' experience as a gunnery officer, giving in conclusion a very humorous anecdote of a common sailor's opinion of the Armstrong gun.

After a few observations from Admiral Taylor, and a gentleman whose name we did not hear, the Chairman called upon Captain Fishbourne to reply, who stated that in his opinion no answer had been given by Sir William Armstrong to his statements made at the commencement of this discussion, and which, therefore, retained their full force. But he thought he had just reason to complain of the tone of Sir William Armstrong's observations. As far as he (Captain Fishbourne) was concerned, everything he had stated was rendered without prejudice, and solely for the benefit of the Service, and he regretted that Sir William Armstrong had not followed the same course.

He alluded to the various observations made by the different gentlemen who had addressed the meeting, as entirely sustaining his original views, and briefly recapitulating the leading arguments of his paper, ended by expressing a hope that the opinions which these meetings had called forth, would prove of advantage to the authorities and the service generally.

MEETINGS FOR THE WEEK.

Mon.—*Royal Geographical Soc.*, The Royal Awards for the "Encouragement of Geographical Science and Discovery" will be presented by the President, Lord Ashburton, at Burlington House, at 1 p.m. The Duke of Newcastle will receive the "Founder's Gold Medal," on behalf of the late Richard O'Hara Burke, for his Expedition across Australia; and also a Gold Watch for Mr. John King, the only survivor of Burke's Expedition. Captain Thomas Blakiston, R.A., will then receive the "Patron's Gold Medal" for his survey of the Yang-tze-Kiang. The President will then deliver his Annual Address on the Progress of Geography. The chair and the dinner at Willis's Rooms will be taken by the President-Elect, Sir Roderick I. Murchison, at 7 p.m. precisely.

Tues.—*Inst. Civil Engineers*, President's *Conversazione*, at 9 p.m.

Royal Inst., "On the Art of the Last Century," by Rev. G. Butler, M A., at 4 p.m.

Thur.—*Society of Arts*, "On the International Exhibition of 1862," by William Hawes. Right Hon. the Earl Granville will take the chair at 8 p.m.

Royal Inst., "On Progress of the Chemical Arts, 1851-1862," by Dr. Lyon Playfair, at 3 p.m.

Royal Soc., at 8.30 p.m.

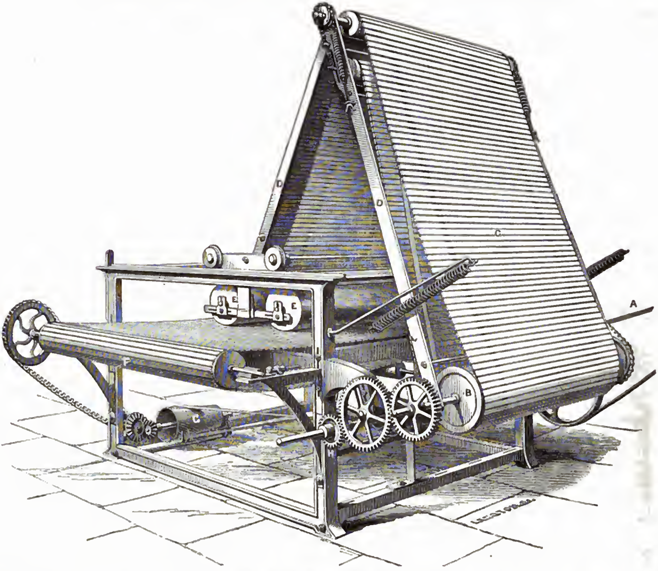
Antiquaries, at 8.30 p.m.

Fri.—*Royal Inst.*, "A Plea for Cotton and for Industry," by T. Basley, Esq., at 8 p.m.

United Service Inst., "The Lines of London; Defence by Works and Manœuvre in the Field, Illustrated by a Model, as shown in the International Exhibition," at 3 p.m.

Sat.—*Royal Inst.*, "On Agricultural Chemistry," by Prof. Anderson, at 3 p.m.

FERRABEE'S PATENT "BAT"-FEEDING MACHINE FOR CARDING ENGINES.



FERRABEE'S PATENT "BAT"-FEEDING MACHINE FOR CARDING ENGINES.

The machine represented by the above engraving is the invention of Mr. James Ferrabee, of Phœnix Iron Works, Strond, and is shown at work by Messrs. Platt Brothers, of Oldham, in the Western Annex of the International Exhibition, where it attracts considerable attention, not only from those immediately interested in woollen manufactures, but also from the general public.

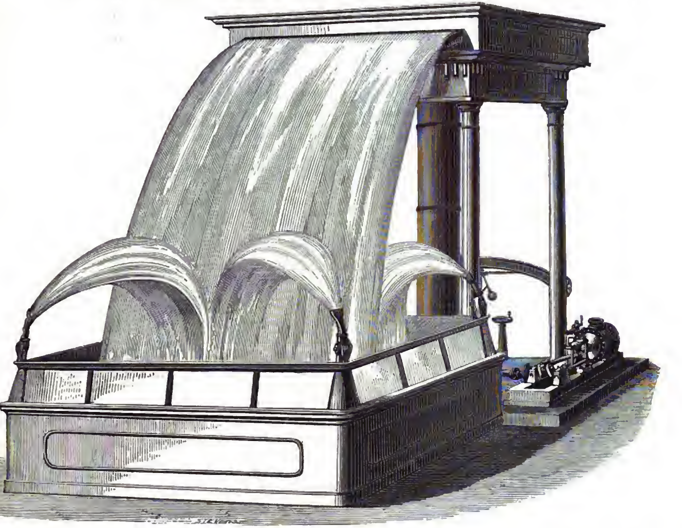
Description and reference to the figure:—The working parts of the machine are sustained in an iron frame. *A* is a strap to give motion through the wheels *H* to the roller *B* which supports and moves the endless travelling lattice *C*. *D D* are levers of a vibrating frame, the long levers having their fulcrums on the spindle of the roller *B*, and the short levers being jointed to the carriages of the tin rollers *E E*; these carriages are moved backwards and forwards on the top of the rail of the frame of the machine by means of an endless belt and stud, taking with them the tin rollers *E E*, and the vibrating frame *D D*; *F* is another endless travelling lattice driven by the cone pulleys *G* and the chain wheels connected therewith. The tin rollers *E E* traverse the lattice *F* to and fro.

The machine being put into motion, wool or other material would be delivered on to the lattice *C*, by which it would be carried forward and deposited between the rollers *E E*; as these rollers traversed to and fro, the wool would be laid in layers one over the other on the lattice *F*, and the thickness of those layers would depend on the speed at which the lattice *F* moved, which can be regulated by shifting the strap on the cone pulleys *G*; the wool thus laid would be passed from the machine by the motion of the lattice F. The invention admits of various modifications to adapt it to the making of unwoven felt-cloths, wadding, and for other purposes, but this notice will be confined to its application to the process of carding wool. In that process wool passes through a series of three machines called "carding engines," distinguished as, first, the "scribbler," second, the "intermediate," and third the "finisher." The three separate cardings performed by these machines, are intended to effect a thorough mixing of the wool, and a uniform distribution of its fibres, after which it is divided and rubbed or "condensed" into round felt "slivers" or bands, to be wound on to bobbins ready for the creel of the mule. Wool, in weighed quantities, is fed to the "scribbler" by hand, and leaves that machine in the form of a thin fleece. Here the "feeding machine" takes it up, and the fleece is, by means of the lattice *C* and the rolls *E E*, carried forward and laid in layers one on the other on the lattice *F*, so as to form what is termed a "bat," the thickness of which may be regulated at pleasure, as above mentioned. The "bat" thus formed is conducted by the "feeding machine" to the "intermediate" or second carding engine, and after undergoing a second carding the wool again appears in the form of a thin fleece, which is taken up by another "feeding machine" and by it formed into a "bat" in the same way as before described, and then conducted to the "finisher" or third carding engine.

Connected to the "finisher" is an apparatus called a "condensor," which divides the fleece as it leaves the carding rollers, and by means of vibrating sheets of leather rubs it into round felt bands ready for winding upon bobbins. Feeding machines may be constructed to form and conduct the "bat" in a direct line from one carding engine to another, or to form what is called a "cross bat," to be fed to a carding engine placed at a right angle to that one from which the fleece would be taken. The illustration shows a "cross bat" feeding machine in which the lattice *C* and rollers *E E* lay the fleece transversely in the lattice *F*. A machine to both *receive* and *feed* in a direct line would have the vibrating frame *D*, the lattice *C*, and the rollers *E E*, to act in the same direction as the lattice *F* moves. The introduction of the "bat feeding machine" enables manufacturers to use "condensors" on coarse wools, which has not been successfully accomplished by any other means, and its capability to properly mix wool and distribute its fibres is said to be a great improvement on the methods hitherto practised.

The explosive force of gunpower is *doubled* by an admixture of salammoniac (*muriate of ammonia*), and again with the oxides of manganese and zinc its explosive power is much increased.

GWYNNE & CO.'s CENTRIFUGAL PUMPING MACHINERY.



GWYNNE & CO.'s CENTRIFUGAL PUMPING MACHINERY IN THE INTERNATIONAL EXHIBITION.

The most attractive piece of machinery in the Western Annex is Gwynne & Co.'s centrifugal pump. It is the "observed of all observers," and nobody should visit the annex without seeing it. We are sorry that from the inadequate supply of steam, this pump cannot be kept in constant work, as it is not only a beautiful object to look at, but it cools the atmosphere and refreshes the senses. We hope that the Commissioners will not lose a single day in providing more steam force, as it is positively unfair to the proprietors of such a splendid piece of machinery, who must have gone to thousands of pounds expense in its erection, to have it working about one-half or one-third of the time that the Exhibition is open. It is also unfair to the visitors, who we find crowd around this leviathan pumping machine immediately the steam is put on. We believe at present it works every alternate half-hour.

The machinery as exhibited, consists of a patent centrifugal pump, driven direct by two horizontal steam cylinders, and arranged so as to draw the water from a tank situated on the ground-floor of the building. After being raised to an elevation of 23 feet into an upper tank (the difference between the water-levels when the pump is at work, is 21ft.), supported on four columns, the water falls back into the lower one in the form of a cascade, 10ft. wide, and 9½ inches deep, the water rising inside the upper tank to 12 inches above the highest level of the mouth-piece. The steam-cylinders working the pump are 18 inches diameter; the pistons have a stroke of 14 inches, and are coupled direct to the pump shaft without any intermediate gearing. The revolving disc of the pump is 4 feet in diameter, the suction and delivery pipes are 30 inches in diameter, and the pump, if worked with 25lbs. steam-pressure in the cylinders throughout the stroke, discharges 110 to 120 tons of water per minute, or equal to three and a quarter times the contents of the lower tank. At a height of 6 feet (the same elevation as Messrs. Easton & Amos' Appold Pump) it will discharge about 400 tons per minute, the engines having the same speed and power. For the discharge of the above quantity, the pump requires a speed of 210 revolutions per minute, which gives out a duty of about 80 per cent. on the power expended, a much higher result than has ever been attained by other centrifugal pumps. A centrifugal ball-governor suspended from an arch between the back columns regulates the speed of the whole machinery, which can also be adjusted, started, or altogether stopped, by means of a small hand-wheel. Surmounting the four corners of the lower tank, are four small pump-cases, connected by means of pipes with the large pump, and fitted with copper mouth-pieces. These last mentioned, on a valve inside the tank being opened, emit streams of water, which, although in comparison with the cascade they appear very diminutive, yet discharge a large quantity of water, and have a pleasing effect. A net work of fine wire covers the under tank to break the fall of the water and prevent sparking and spray, as much as it is possible with such a large body of water falling.

This centrifugal pump is superior to every other form of pump for raising large or small quantities of water, and to any required elevation. We are informed that the following is a summary of its advantages:—

1st. It can be erected with ease and celerity, and works with an easy rotary motion, without any valves, eccentrics, or other contrivances, which consume power in friction.

2nd. It will discharge a quantity of water greater in proportion to the power applied than any other pumps, 70 per cent. being taken as the average; under favourable circumstances a higher duty has been attained.

3rd. It is economical in use, simple in construction, of great durability, and will discharge a continuous and steady stream without air vessels.

4th. Its cost, measured by the quantity of water discharged, is below that of all other pumps in use, and it is little effected by mud, sand, grit, or other foreign matter in the water which so rapidly destroy most other pumps.

5th. It will admit, in the large sizes, the passage of *solid bodies* six inches in diameter, and the smaller sizes in proportion without injury, whilst it will pump with equal facility hot or cold liquids.

6th. It requires a very light and inexpensive foundation (having no vibration or oscillation in its working, as in reciprocating pumps).

No correct opinion can be formed of the great efficacy of this pum[illegible] by regarding the four conditions ess[illegible]per estima[illegible]drauli[illegible]he *power* [illegible] *height to* *which it is raised, and the time required to raise it.* Casual observers omitting these considerations, and looking only at the size of the machine, and the diameter of the discharge pipe, may be led to form a very incorrect judgment on this important point.

GOLDMINING AND THE GOLD DISCOVERIES MADE SINCE 1851.

(Continued from page 327.)

The most remarkable deposit of auriferous quartz hitherto found in Nova Scotia is undoubtedly that at Laidlaw's farm. The principal workings are here situated near the summit of a hill composed of hard metamorphic shales, where openings have been made to the depth of some four or five feet upon a nearly horizontal bed of corrugated quartz of from eight to ten inches in thickness. This auriferous deposit is entirely different from anything I had before seen, and when laid open presents the appearance of trees or logs of wood laid together side by side after the manner of an American corduroy road.

From this circumstance the miners have applied the name of "barrel quartz" to the formation, which, in many cases, presents an appearance not unlike a series of small casks laid together side by side and end to end.

The diagram on the wall will serve to explain the mode of occurrence of this deposit.

The rock covering this remarkable horizontal vein is exceedingly hard, but beneath it for some little distance it is softer and somewhat more fissile. The quartz is itself foliated parallel to the lines of curvature, and exhibits a tendency to break in accordance with these striæ.

The headings, and particularly the upper surfaces of the corrugations, are generally covered by a thin bark-like coating of brown oxide of iron, which is seen frequently to enclose numerous particles of coarse gold, and the quartz in the vicinity of this oxide of iron is itself often highly auriferous.

The other gold veins of the province present, generally speaking, few distinctive peculiarities, and very closely resemble those found in California and Australia. Their general course is north 60° west, and their dip towards the south, but there are not unfrequent exceptions to this rule.

In addition to gold, the most auriferous veins of Nova Scotia contain variable quantities of iron-pyrites, mispickel, galena, blende, and less frequently a small proportion of argentiferous and auriferous sulphide of copper. Here, as elsewhere, the presence of the sulphides is regarded as a favourable indication of the richness of a vein, and leads containing much disseminated galena almost invariably yield a remunerative quantity of gold.

The productive veins hitherto discovered have, as before stated, been found in the older rocks on the Atlantic shore, and commonly occur in parallel groups near the centre of which, and parallel to the productive veins, a large reef of crystallized and comparatively unproductive quartz is in many instances found to run. These large courses are locally called "bull veins," and usually contain small quantities only of the precious metal.

The attention of the Nova Scotian gold miners has, contrary to the usual practice, been almost entirely directed to the explorations of the veins of gold quartz, and alluvial digging has consequently been all but entirely neglected. There is, however, every reason to believe that a careful examination of the alluvial deposits would lead to the discovery of large quantities of gold.

It would be impossible to form any reliable estimate of the total amount of gold which has hitherto resulted from mining operations in Nova Scotia, as the claims are for the most part worked by private individuals who are generally indisposed to furnish information either as to their success or failure, and no official returns on the subject have as yet appeared. It is manifest, however, from the characteristics of the localities in which the precious metal has already been discovered, and the great extent of the gold bearing portions of the province, that there is every reason to anticipate that further and more important results will be developed by the workings and explorations of the present summer, and that, ere long, Nova Scotia will take an important position among gold producing countries.

The thickness of its auriferous veins is perhaps less than those of California and some other countries, but they are, generally speaking, richer in visible gold than the average of those I have seen in any other part of the world. It must also be taken into consideration that Nova Scotia possesses many decided advantages over both California and Australia. Each of these countries is situated at a great distance from Europe, and can only be reached after a long and expensive passage, and, as a natural consequence, wages were for a long time exceedingly high and provisions proportionately dear. Nova Scotia, on the contrary, is within an easy distance both from Europe and the United States of America, and possesses a considerable settled population of intelligent, industrious, and sober people, eminently adapted, after a little experience, to become steady and efficient miners. The whole of the gold bearing portion of the province also lies within a convenient distance from the coast, which abounds with magnificent harbours, affording ample security to shipping, whilst wood in large quantities is to be everywhere procured for all descriptions of mining uses, and an abundant supply of water is generally to be met with for the purposes of washing and amalgamation.

From these circumstances, it is impossible that wages can ever reach the extravagant rates that mainly led to the failure of nearly all the gold-mining enterprises of 1852, since which period many of the mines have been advantageously worked which were then abandoned on account of the enormous expenditure necessary to carry on the operations.

Gold of North Wales.—The gold district of North Wales would appear to be chiefly confined to an area of about twenty square miles lying on the north of the turnpike road leading from Dolgelly to Barmouth. In this region the Cambrian rocks are overlaid by the Silurian, and the general geological features of the country strongly resemble those of other auriferous localities.

The most important discoveries have been made in the Dol-y-frwgnog, Prince of Wales, and the Clogan mines, of which the latter only is at the present time worked with remunerative results. So long ago as 1844 a paper was read before the British Association by Mr. Arthur Dean, who stated that a complete system of auriferous veins exists throughout the whole of the Snowdonian or Lower Silurian formation of North Wales. In consequence of this statement operations were commenced at Cwmhesian, but the results obtained not having been found satisfactory they were finally abandoned. Ten years subsequent to this the mine was again worked for gold, but still with unfavourable results. Machinery for crushing and amalgamation was about two years afterwards erected at Dol-y-frwgnog, but after operating on several hundred tons of quartz, the result was in this instance also a failure. Of all the auriferous veins in the neighbourhood of Dolgelly that at present worked in the Clogau mountain is certainly the most important. This mine is situated at a height of about a thousand feet from the level of the sea, and the workings are extended on what is called the "St. David's" or "Gold lode." This lode, which is almost perpendicular, runs nearly east and west, and is chiefly composed of auriferous quartz, more or less impregnated with sulphides of iron, lead, and copper. The vein stone also exhibits large quantities of disseminated gold, which generally occurs in a state of minute division. This mine is being worked on a small scale, and by means of very simple and far from perfect machinery; the following returns were however made during the course of the year 1861:—Ore crushed, 456 tons, 32lbs; fine gold obtained, 2,884 oz., 1 dwt., 7 grs., being at the rate of 6⅓ ounces per ton of quartz operated on. During the current year, up to April 26th, the results have been:—Ore crushed, 255 tons, 16 cwt., 16 lbs.; fine gold obtained, 1,962 oz. 2 dwts., or 7⅔ ounces per ton of quartz.

It is needless to add that such a degree of success has given rise to the commencement of numerous mining operations in various parts of the district, but if gold mining in Merionethshire is approached in the speculative spirit that characterized the proceedings of 1852, it requires no prophet to foretell that numerous failures must necessarily be the result.

Methods for Extracting Gold from its Matrix.—The most simple and at the same time most ancient method for obtaining gold is undoubtedly by washing the sands and dirt with which it is found associated. On a small scale this may be performed either in a bowl or tin pan, but when greater expedition is sought, recourse must be had to appliances of a somewhat more complicated nature. Among the earlier miners in California and Australia the *cradle* was much employed. This instrument appears to have been introduced from Virginia and Carolina, and consists of an oblong inclined box, having a sieve at its upper extremity mounted on rockers, so that by means of a handle it may be swayed from side to side. The interior of this case is provided with a sloping diaphram of tightly-stretched canvas, and the bottom is divided into partitions by means of wooden cleets. Washing by the cradle is, however, a very slow operation, and requires a great deal of manual labour, since besides rocking it is necessary to supply it with water by means of a dipper, and to continually stir the fresh brought stuff deposited on the sieve. The gold and other heavy bodies retained between these wooden divisions are finally rewashed in a tin pan, and the metal is thus obtained in a pure state. The losses of fine gold attending this operation are very great.

(To be concluded in our next.)

TO CORRESPONDENTS.

Received.—J. B., J. N. C., "Well-Wisher," C. W. F., C. M. and Co., A. G., W. H. R., Capt. H. G., Capt. A., Messrs. G. and Co., C. and Co., Glasgow, J. W. T., S. T., G. W., C. B. K. and Co., Zouave, J. A. D., Dr. E. D. C. L., call at the office.

Enquirer.—The inventor of the system of marine telegraph signals, described in our last, is Mr. W. H. Ward, Auburn, New York.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

GRAND CANAL FROM PORTSMOUTH TO LONDON.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Three millions of property was captured between Portsmouth and London during the last war, and as our golden fleets from Australia and Vancouver's Island will run the same risk, it is obvious whether considered in a national or domestic point of view, or whatever may be the cost, the importance of this undertaking must not be overlooked. [Our correspondent is sanguine that it may be executed at the cost of £4,000,000, and in a *very short period* by means of a set of steam ploughs of various forms, and having several sets of *blades* attached to the ploughshares, suited to the nature of the soils to be intersected or excavated.] The necessity of this measure is absolute, as in the event of a war with France, the port of London would be effectually blocked up from all communication with the British Channel, the whole space between the Isle of Wight and the Forelands being so exposed to the French ports that no vigilance on the part of our Navy could save our merchant shipping and coasts from the activity of the French gun-boats; for in a long dark night none of our vessels could give protection to more than four merchantmen, and even these would be hazarded. Many thousand lives now annually shipwrecked would, by this scheme, be saved. It is suggested, in order to defray its cost, either to divert some of the monies voted for the *impotent* stone batteries, or to make it a national undertaking, and to pay the expenses of its construction by an issue of 4 per cent. Exchequer bills, and 5 per cent. canal debentures, the latter to be paid in 15 years. Vessels passing through the locks to pay £35 per hundred

Digitized by Google

tons. It would likewise be an excellent route for the Admiralty and War Office forwarding stores to the South-West districts in time of war. The following are the particulars:—

The canal is to be 78 miles from Portsmouth Harbour to London. Depth of water 18 feet; width 160 feet; it will require only 4 locks, as the summit level on Epsom Common will not exceed 140 feet; and the deepest cutting will be 130 feet. The locks will be 300 feet long, and 64 feet broad. It is proposed to shut up Langston Harbour, and open a new entrance to Spithead. The canal will commence, with two branches, at Rotherhithe, nearly opposite the London and West India Docks, and proceed thence in a south-westerly direction to Walworth common, by the foot of Brixton hill to Streatham common, then between the villages of Mitcham and Tooting to Malden, Ewel, Epsom, Leatherhead, and Dorking, over Homewood common, down the vale to Ockley, and the Roman turnpike gate, a little below Slinfold, Newbridge, Pulborough, by Hardham, Greatham, Amberley, Burkham, Arundel (and a small branch to Arundel Bay), and lastly to Chichester, Emsworth, Langston Harbour, Southsea common, and Spithead. (The canal, in addition, by means of pipes laid down at its sides, would supply London and the places through which it passed, with the purest water for drinking and household purposes, thus realizing a large income).

To establish an accurate comparison between the work of ploughs and that done by the pickaxe and spade, a piece of ground in Wurtemburg, in 1824, was wrought solely in the latter manner by six strong working men. The result of a long trial was the breaking of 150 cubic feet of ground by each man in nine hours. Comparing this result with the work of the plough used, having two handles, and a coulter, and a share, the latter being in the form of a wedge. The plough was drawn by eight horses, and was preferred in the beds and gravelly grounds; and it was found advantageous to give it an oscillatory movement by the handles during its progress. This plough did the work of 477 men, turning up 25,000 cubic feet of an argillaceous soil in three hours; with *ten* horses it turned up 19,800 cubic feet of a gravelly soil in the same time. *The canal was finished in one year, the ploughs having saved* 32,000 *days, according to the work day of a labourer.* James Bruce.

◆

ATLANTIC TELEGRAPHS.

Sir,—Mr. Saward objects to my view as to the old Atlantic cable having been injured by endeavours made to work through it at a high speed, because, he says, there were slight faults in the cable before it left Plymouth. I do not for a moment imagine that any cable that has ever been laid has been *perfect;* and the tables exhibited at the last meeting of the Institution of Civil Engineers, show that this was the case with the Alexandrian line; for the insulation of the three sections is shown to be very different, one from the other. But the pre-existent faults which are now stated to have been the cause of the failure of the Atlantic line, have only been assumed by one of the several gentlemen employed by the company, *after the event*, to make up a report, who had never in any way tested the cable before it was laid, or had any experience whatever in long or deep-sea cables; and who, in his report, upon which such a superstructure of fiction is raised, states that he does not know when or where the mythical figures upon which he based his assumption were obtained!

For my part, I am very reluctant to accept Mr. Saward's argument, although I have already a very small opinion of the value of the present system of managing public companies by boards of directors.

Are we to believe that during the three weeks in which Mr. Saward and the directors were daily publishing those exciting reports of the most perfect and brilliant success, given in my former letter—while the shares were rising on the Stock Exchange, and while instructions were given by the directors to place large numbers of shares,[*]—they were only acting in concert to keep up the steam by using "enormous and unnecessary currents" through a sick line, which was gasping out its last word and testament? Were the congratulatory messages between the directors in England and America, the feasting, and that journey of the board to Valentia, "to make arrangements for opening the line to the public," all a series of shams to throw dust in our eyes? I cannot for a moment believe it without losing all faith in directors, secretaries, *et id genus omne;* and if it is true, how can we credit any reports whatever as to the state of the line emanating from the company?

The following extracts from the published certified statements of messages sent through the cable are in support of my view respecting the endeavour to fulfil the company's promises of working through at a fast rate having killed the golden goose.

Date.	Time.	Station from	Station to	
Aug 16	2 57 A.M.	Newf'dl'd.	Valentia..	All right but three letters. Please ask some questions, but *work faster.*
"	2 30 P.M.	Valentia...	Newf'dl'd.	Repeat all back *faster.*
"	1 39 "	"	"	Can we send *faster?*—*You can.*
"	2 8 "	Newf'dl'd.	Valentia..	You may go a little *faster.*
17	8 12 A.M.	Valentia..	Newf'dl'd	Send correct; *go faster.*
"	9 10 "	"	"	*Send fast.*
19	7 0 "	"	"	Send messages *fast*
20	2 35 "	"	"	Can we send *faster?*
"	3 20 "	"	"	Send *faster.*
"	10 45 "	"	"	Try and send *faster*
21	7 8 P.M.	"	"	Use *hundred Daniell's* with reversing key in your next.
"	7 18 "	Newf'dl'd.	Valentia...	We are getting ready Daniell's. If you send again, *send faster.*
23	10 57 A.M.	"	"	Send little *faster* and better.
"	11 18 "	"	"	All right, send much *faster.*
24	11 30 P.M.	Valentia ..	Newf'dl'd.	Send much *faster.*
25	1 31 A.M.	Newf'dl'd.	Valentia...	Splendid signalling!

After they had thus got steam fully up, they appear to have had some glimmering of the error they were committing in overdoing a good thing; for on the 21st August, Newfoundland begged Valentia to "send slower." On the 27th, Valentia was requested to "work slowly," and again, the same day, Newfoundland urged Valentia to "send slower." Notwithstanding this, Valentia ordered him, on the 28th, to "send faster;" and soon after that, the high battery power used broke down the line for ever.

These authentic and undisputed facts bear with them a conviction, superior to any surmise upon questionable and unsupported data.

As regards the difficulty of working through long cables, and the law of that difficulty being increased as the square of the distance, which Mr. Saward does not believe in, I can only say that it is generally received by those whose telegraphic experience has been of a practical kind. Sir C. Bright, Professor Thomson, Mr. Varley, Mr. Siemens, Mr. Jenkins, and others, are usually supposed to support this view, and if I am wrong, they will, no doubt, correct me. I am so far inclined to "stick to my last," that I will not dispute any points which Mr. Saward may raise as to the duties of a secretary, or the art of official correspondence, in which he is an expert of the first class; but I cannot take his inexperienced "belief" upon a practical subject against the judgment of such men as I have named above.

I cannot ask you to give me space to follow up the discussion on the North Atlantic *versus* the direct Atlantic route; but if you are willing to spare me room another week, I should like to do so.

I must, however, say that Mr. Saward does not tell quite the same story at different times; for in a letter published in the *Times*, dated May 19th, 1860, he gave the greatest sea length on the northern route—that from Iceland to Greenland—at 650 miles, to which he added 15 per cent. for slack (10 per cent. would be nearer the mark, as part of the line is in shoal water), making 747½ miles. In his letter in your last number, he takes another leap, and runs it up to 920 miles!

I must also correct him in his statement that Sir Leopold McClintock did not find it "possible to discover even a feasible landing place in Labrador." His duty was to take the soundings in the late survey; and the Fox, under Captain Allen Young, had to survey the landing places. It was too late in the season for the latter to get to Labrador. Hence Sir Leopold said in his published letter to Sir Charles Bright (after giving the result of his survey most decidedly in favour of the northern route):—"It only remains for me to notice Labrador. The landing place for a shore end has yet to be sought for; the interior, I was told, would present no difficulty whatever for a land line."

Short Circuit.

RUDDERS.

Sir,—Your correspondent, "Practical," in his remark upon the alteration of the working of rudders as proposed by "Half Pay," has not, I think, taken into account the disposal of the force due to the water, relatively in motion, on the starboard side of the keel. It, doubtless, impinges upon the water deflected from the fore part of the rudder; but so infringing, its oblique force is nevertheless imparted indirectly to the after part of the rudder, by driving the deflected water against the rudder.

In the absence of experimental results, I am inclined to think that "Half Pay" has taken a correct view of the matter. J. H.

May 17th, 1862.

◆

THE MIDDLE LEVEL CATASTROPHE.

Sir,—As the German ocean covers more than ten thousand acres of the richest land of Norfolk, and the decision come to by the Middle Level Commissioners, is to have barges laden with clay bags to be sunk in the current, and the engineers are employing hundreds of men in filling bags with clay, and twisting lengths of willow, all of which are swept away, and all their efforts to arrest the rush of water through the gap appear to be in vain,—

I beg to suggest an expeditious and inexpensive method, by which the gap or breach can be repaired, and consists of spreading on the bottom of the sea near the breach or gap, a sheet of strong naval canvas, which can be made in sections and laced together to any size; the end towards the sea to be held securely to the bottom by weights or anchors, and the shore end surrounding the breach or gap to be raised sufficiently high, and secured to suitable, vessels, anchored across the breach or gap, forming an efficient abutment to the shore end of the sheet, on which clay bags or other suitable material may be put, which will effectually prevent the entrance of water during the time of repair; as steamers and canvas can be prepared at once, I would undertake to prevent the inroad of water through the gap or breach in a very short time; when such a national disaster occurs, publicity puts the public in a position to know what is best to be done.

J. Macintosh.

May 21, 1862.

Gossip.

The French Imperial library, in the Rue de Richelieu, Paris, has undergone recently a complete transformation, and the new reading room, which is of immense size, will shortly be thrown open to the public. The library contains 1,800,000 volumes, and the shelves on which they are arranged measure 17 miles in length. It is generally supposed that the library collected by Charles V. in the Louvre formed the nucleus of the Imperial library, but this is an error. That library was purchased by the Duke of Bedford during the British occupation of Paris in 1815.

Having lately referred to the extraordinay step taken by the British Government towards the end of the 18th century, of permitting the public to coin copper money in the form of tokens, and thus superseding the legitimate currency of the kingdom, it may not be improper to refer also to the coinages of the Romans during the period that they swayed the rod of Empire over the civilized world. The coins of that period are remarkable for the variety of the devices ornamenting them, and they have descended to us in prodigious numbers. In every country once under their dominance numerous hoards in the three metals, gold, silver, and copper, or in bronze, have from time to time been brought to light. In England, France, Italy, Germany, and in the more remote provinces of the East, innumerable discoveries of Roman coins have served to enrich the cabinets of the curious, and to give information and delight to the historian, the antiquarian, and the artist. The Romans, indeed, with a foresight which has been seldom evinced by modern nations, celebrated those deeds which have been the admiration of succeeding ages in a manner peculiarly their own. Time, accident, or other eventuality they knew might destroy temples and statues;

"Sceptre and crown must tumble down,
And in the dust be equal made
With the poor crooked scythe and spade."

But their coins were calculated to perpetuate their fame to the remotest times. The coins of the Romans were in fact their "gazettes extraordinary" and they were sometimes published in the most remote provinces. Up to this day they are frequently discovered in remote regions where our records have perhaps hardly reached. When a victory was gained, or a province reduced, coins were struck, and issued in great numbers, and upon these the vanquished were depicted in their native costume, and with their characteristic arms in their hands or beside them. When the Emperor visited the conquered territory, coins instantly appeared upon which he was represented as a pacificator raising a prostrate female emblematical of the country which had now won the imperial favor. The building of temples to their deities, public edifices for the people, the remission of taxes, the forming of new roads, the celebration of games and sacrifices, and traditional records, are all to be found emblazoned on the coins of that once proud and mighty empire. Of their execution as works of art, it is enough to say that many of the coins referred to have gained the admiration of eminent sculptors and engravers of our own time, and that they may be well employed as models by those who wish to become eminent in those professions.

---

[*] Blue Book on Submarine Telegraphs, p. 235. Message from C. M. Lampson (director of the Atlantic Telegraph Company), London, to Cyrus W. Field, New York, August 23rd, 1858 (fourteen days after the laying of the cable):—"We desire you to place in America about fifteen thousand pounds unappropriated twenty pound shares, authorized February last."

There are at the present time a number of agents of the Federal Government in the districts of South Staffordshire endeavouring to secure supplies of armour plates for iron vessels of war on the *Monitor* model. Agents of the Dutch and other Governments are also among the ironworks of this locality for a similar purpose. The Federal representatives are desirous of securing plates somewhat below what may be considered the standard of 4½ inches, but the general demand of the foreign agents is for plates this thick. It is to be hoped that a proper supply will be found of the requisite sort of iron, as a large and permanent trade would thus be secured to the district.

The model in clay of the statue of the Prince Consort, which is to be the munificent gift of the Mayor of Manchester to his fellow citizens, is completed in the studio of Mr. Noble, Bruton-street, Berkely-square. It presents a remarkable striking likeness of the lamented Prince, and the general treatment of the subject is excellent. H.R.H. is represented as wearing the robes of the Order of the Garter. On the front of the pedestal will be placed the inscription:—"Albert the Great and Good." At the back of the pedestal will be inscribed the words, "Presented by Thomas Goadsby to his fellow-citizens, A.D. MDCCCLXII." The statue is to be of the purest Carrara marble, and will be eight feet in height. It is hardly necessary to state that the funds raised by public subscription are to be devoted to providing the pedestal and the protecting temple in which the statue is to be placed. The cost of the temple will be defrayed by the Mayor. As usual, the men of Manchester are up and doing while others are debating about what shall be done.

On Wednesday last the first of the iron armour-plates with which the iron-plated frigate Royal Oak, 50, building at Chatham, is to be encased, was successfully fixed in its place. The plate forms the first of the lower tier, which will be carried five feet below the water line, so as to prevent any shot touching the vulnerable parts below the water. Previously to the plates being fixed yesterday they underwent the process of annealing in the factory, as they are all of hammered iron, being too hard and tough to allow of their being worked in their original state. They were then submitted to the hydraulic plate-bending machine which has been erected at the dockyard by Messrs. Westwood, Baillie, Campbell, and Co., and, while cold, bent to the exact shape of the portion of the ship's side they were destined to cover. As this is the first machine of the kind erected for the Admiralty, considerable interest was taken in the process of bending the plates, most of the leading officials connected with Chatham Dockyard being present on the occasion. Notwithstanding the massive size of the plates, each of which is 13ft. in length, 4½in. in thickness, and weighs upwards of 80cwt., the powerful hydraulic engine twisted and bent them with ease; the slabs operated upon, all of which are from the Thames Ironworks, not exhibiting the least flaw, which, had such existed, would have been instantly detected.

Single Shaft Mines.—In compliance with a circular from the Secretary of State the inspectors of mines have made reports upon the subject of single shafts. It appears from these reports that the practice of having double shafts is extending more and more. Mr. Dickinson states that, having conferred with seven of his colleagues, he is prepared to recommend that an Act be passed requiring two distinct shafts to be provided in every instance, except where a small tract is being worked by not more than ten persons. Mr. Brough even recommends three openings for fiery collieries—one for the downcast and pumps, a second for winding only, and a third or upcast to be dedicated entirely to ventilation. Mr. Blackwell, however, after reporting on the Hartley Colliery catastrophe, states his opinion that single shafts should not in future be permitted; but, with regard to mines now in operation, he feels obliged to represent that in the instance of deep mines, where large quantities of water have been stopped back by tubbing, and where the strata present unusual difficulties, the sinking of a second shaft would involve an outly so serious that a legislative enactment enforcing such an expenditure would probably cause their stoppage, and throw out of employment a large number of the mining population.—*Times.*

Moulding Wood by means of Steam.—This is one of the *artes deperditæ* of the ancients, and was known to the builder of the first ship Argo, in the fabrication of that renowned vessel, in softening the timber in order to adapt it to the several curvatures of the ship, to the great saving of materials and labour.—*Vide Book I., verse 125, of the Argonautics of Valerius Flaccus.*)

Intense Heat.—Many chemical operations have been hitherto interrupted for the want of a power to augment the intensity of the fire. The application of *hydraulic principle* to the construction of *Macquer's* furnace will enable us to carry heat to such a point as to smelt platina. Pyrometrical experiments demonstrate that *coal* is one of the *weakest* conductors of caloric, and that a substance enclosed in coals only receives at the same fire two thirds of the heat of a similar substance placed in siliceous sand. This may serve to rectify the processes of fusion and reduction in the present time.

British Museum.—The following notice has been issued:—The number of persons attending the reading room has increased largely for some time past. Whilst the reading room cannot conveniently receive more than 300 persons at one time, there have been lately days on which nearly 700 have sought admission to it. In consequence, readers are sometimes unable to obtain seats; while the multitude of books applied for renders delay in procuring them unavoidable. This overcrowding, and the daily attendant thereon, are mainly attributable to the influx of young persons who have not yet completed their education, and who come to the Museum to use books of an elementary or ordinary character, which they might easily obtain elsewhere. To remedy these inconveniences as far as possible, and to preserve to the uses of those best entitled to them the advantages and facilities afforded by the library and reading room of the British Museum, the trustees, though with great reluctance, are compelled to raise the limit of age at which persons shall be admissible from eighteen to twenty-one years.

Trotman's Anchors.—The following is a brief summary of evidence on Trotman's anchors given by Admiral J. Denman, in answer to questions addressed him by Admiral Duncombe and Sir James Elphinstone (before the Select Committee, last Session, on Admiralty Administration):—"I made personal application for these anchors after the most formal investigation by a committee of officers into the properties of various anchors, and Trotman's anchors have been in continual use on board the Royal yacht since 1854. In practice I have always found them to bite and hold perfectly. We go into all sorts of harbours and places where the tenacity of our ground-tackle is thoroughly tested, oftentimes having to bring up suddenly in narrow rivers with very strong tides,—in fact, to 'snub' her, and the anchors never failed us in any way. I consider Trotman's anchor very superior to the one known as the Admiralty anchor, and every way preferable; its lightness, too, is a matter of considerable importance. Were I transferred to-morrow to the command of our largest line-of-battle ship, I should be most anxious to have Trotman's anchor, and it is my opinion the Admiralty should have been more ready to supply it to the navy."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c. 2708, 2732, 2749.
Boilers and their Furnaces, &c., 2741.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2734, 2751.
Ships and Boats, including their fittings, 2701, 2705, 2720.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2704, 2740, 2753
Food and Beverages, including apparatus for preparing food for men and animals, 2710, 2754.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2709, 2712, 2717, 2728, 2742, 2747.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c. 2722.
Lighting, Heating, and Ventilating, 2711, 2721, 2750.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2716, 2719, 2723, 2724, 2729, 2730, 2733, 2737, 2743, 2745, 2748, 2752.
Metals, including apparatus for their manufacture, 2707, 2735, 2744, 2746.
Chemistry and Photography, 2700, 2726, 2739.
Electrical Apparatus, 2725, 2755.
Warfare, 3, 2679, 2703.
Letter-Press Printing, &c. *None.*
Miscellaneous, 2698, 2699, 2702, 2706, 2713, 2714, 2715, 2718, 2727, 2738.

2698. W. and T. Ryder. *Improvements in machinery for fluting rollers.* Dated Oct. 28, 1861.

The object of the first part of this invention is to regulate the depth of cut of all the cutters simultaneously, instead of regulating each one independently of the others, as is now customary. For this purpose the patentees support the lead to which the tool boxes are connected in eccentric bushes, each of which is furnished with a toothed wheel, driven by pinions fixed to a side shaft. To this shaft is attached a hand-wheel, with divisions on its circumference, and by turning this hand-wheel partly round, the eccentric bushes acting on the bar cause all the cutters to rise or descend simultaneously, thereby regulating the depth of cut of the cutters. The second part of this invention consists in a combination of machinery for cutting diagonal flutes in or on rollers. In accomplishing this a slight lateral motion is given to the cutters by means of a template fixed to the carriage, acting on a lever which communicates the requisite to and fro motion to the boxes or slides supporting the cutters. By this means the rollers remain stationary while the cut is given, and they are torned partly round after each cut in the usual manner. The above improvements may be used in combination with each other or separately. *Patent completed.*

2699. W. Clark. *Improvements in the means of obtaining and producing printing surfaces.* (A communication.) Dated Oct. 28, 1861.

This relates to printing blocks for typographic and other purposes, in which the characters or designs are obtained in relief; and also to copper plates, in which the designs are sunk in the surface, for printing either paper or fabrics. The blocks or plates are formed as follows: a slab or plate is first suitably prepared and polished, on the surface of which is engraved a suitable design with an ordinary graving tool. The engraved design being completed, the slate slab is then prepared by the ordinary means, and submitted to a galvanic bath of salts of copper, which causes a layer of copper, deposited on the slab, to penetrate into all the hollows of the designs, and to become solidified. The copper, on being detached from the slab, furnishes a surface of block in relief, which is then moulded and employed as usual. *Patent abandoned.*

2700. G. M. Gilbert. *Improvements in preparing blue color, and apparatus for applying such color to water.* Dated Oct. 28, 1861.

The preparations of blue coloring matter, according to this invention, are made up in the form of paste or semi-fluid, which is preserved for use in suitable flexible vessels. These compositions of blue coloring matter are packed in suitable cases, which, when they are to be used in place of the ordinary blue bags of the laundry, are made of tin or lead, similar to those which have heretofore been used for storing artists' colors, but modified as follows: Near the outlet end of a case or vessel is a partition of some suitable material, around which, and between it and the interior of the case or vessel, the edges of a porous bag, of flannel or other suitable material, are tied before forcing the the partition into the case or vessel, so that the upper end of the vessel is lined with such bag. The upper end of the vessel is perforated with holes, so that when a quantity of the soluble blue coloring matter is pressed through a hole in the partition into, and is contained in, the bag, the vessel may be used by placing the outlet end thereof into water, and by moving it therein the desired quantity of blue color may be diffused in the water. *Patent completed.*

2701. G. Audony. *Improvements in the mode of, and apparatus for, raising sunken ships and other sunken bodies, and also in structures or apparatus intended for being purposely sunk or raised.* Dated Oct. 28, 1861.

The chief object of this invention is to raise sunken ships and other bodies. For this purpose the inventor constructs apparatus in which a chamber or space, or chambers or spaces, from which he exhausts or extracts the air, or in which he produces a vacuum, or what is practically so called, and brings the same into communication with the interior of the sunken body, so as to draw out a quantity of water therefrom, whereby the body is lightened and raised. *Patent abandoned.*

2702 J. Watt and T. S. Haviside. *Improvements in the manufacture of soap.* Dated Oct. 29, 1861.

This relates to the manufacture of white soap and pale yellow soap from kitchen stuff, ship fat, and other similar, inferior, and dark colored fat or grease; and it consists in the application and use, in the manufacture of white soap and pale yellow soap, of the distilled fat acids that are obtained from kitchen stuff, and other similar, inferior, and dark colored fat or grease. *Patent completed.*

2703. O. Bayliss. *Improvements in double sighted double rifle guns for military and sporting purposes.* Dated Oct. 29, 1861.

This consists in fixing a top and bottom sight on each of the barrels of a double rifle or gun, instead of fixing one top and one bottom sight on a rib between the barrels, as

Digitized by Google

is commonly practised. By placing a top and bottom sight on each barrel, the aim of the rifle or gun is made more true, and the crossing of the balls is avoided. The invention consists further of a double top rib for the same purpose, the said rib being double top and bottom sighted. The said rib is fixed on and extends from end to end on the top side of the barrels. The invention consists further in sighting the left hand barrel without sighting the right hand barrel of double rifles or guns, or sighting the right hand barrel without sighting the left hand barrel. The invention is applicable to double rifles and guns of any bore and of any length. *Patent completed.*

2704. J. Martin. *Improvements in granories, and the apparatus connected therewith.* Dated Oct. 29, 1861.

This consists in constructing together, and in combination with each other, a number of tall, square, or other suitably-shaped chambers or bins for the reception and storage of grain, which chambers are to be supported on arches of brick or stone, or elevated girders. The grain is carried above the top of the chambers or bins by elevators; from the buckets of the elevators the grain falls into a suitable hopper, which is provided with a swivelling discharge pipe, from which the grain falls into the chamber or bin, over which it is placed; or the grain falls into a spout or channel fitted with a longitudinal archimedean screw of a coarse thread, by the rotation of which screw the grain is carried forward to and discharged at the part required; or if preferred the screw can be a fixture, and the external causing made to rotate. *Patent abandoned.*

2705. E. Suckow and E. Habel. *Improvements in anti-friction mechanism for receiving the end thrust of screw-propeller and other rotating shafts.* Dated Oct. 29, 1861.

This consists in the application of one, two, or more pulleys, to receive the end thrust of screw propeller, and other rotating shafts, which pulleys are placed with their axis in suitable bearings at a right angle to the axis of the shaft. The peripheries of the pulleys come against a ring collar fixed on the shaft. The edge of the pulleys are made half round, and the prepared ring or surface on the shaft, upon which the pulleys act, is made flat, or *vice versa*. The pulleys may be placed in a box, so that they can be wholly or partly submerged in oil or other lubricating material. *Patent abandoned.*

2706. J. Bibbington. *Improvements in machinery for breaking and crushing limestone and other hard substances.* Dated Oct. 29, 1861.

This invention is not described apart from the drawings. *Patent abandoned*

2707. F. Bennett. *An improvement in the manufacture of spelter.* Dated Oct. 29, 1861.

This invention consists in mixing or incorporating chloride of sodium or other substances containing chlorine, to be hereinafter named, with the materials now generally used in the manufacture of spelter, after their calcination, and then subjecting the materials so mixed to the usual smelting process. The patentee carries his invention into effect as follows:—He first calcines the blende calamine or other zinc ore in the usual manner, next mixes such ore with coal, coke, or other carbonaceous matter and adds chloride of sodium—common salt. The proportions he has found best in practice are about four per cent., by weight, of the chloride of sodium to the calcined ore, but this may be somewhat varied without injuriously affecting the result. He then subjects these mixed materials to the ordinary smelting or deoxidating process in the retorts or other usual apparatus, the product being condensed and collected in the usual manner. Instead of chloride of sodium he uses other substances containing chlorine, namely, chloride of lime, muriatic acid, or chloride of calcium, in the same proportions and at the same stage of the process. *Patent completed.*

2708. W. H. Furlonge. *Improvements in the condensation of steam by surface contact.* Dated Oct. 29, 1861.

This invention relates to causing the steam which has performed its duty in the cylinder to pass into a condenser, in which condensation is effected by cold water being brought in contact with tubes or vessels in which the steam is contained, and the invention consists in bringing water into contact with and carrying it off rapidly from such surfaces by means of a centrifugal pump, or some analogous form of rotary disc. The invention is applied to what are known as condensing engines, and to the working of non-condensing or high-pressure steam engines, in order that the steam, after having performed its duty in the cylinder, may be passed into the surface condenser, and be reconverted into water, which is returned to the boiler. This invention is more especially designed for marine purposes, as permitting the adoption of non-condensing steam engines by steam vessels, whereby a large saving is effected in boiler and engine-room space, first cost and working of machinery, and in the quantity of fuel consumed. *Patent completed.*

2709. W. Savile. *Improvements in machinery or apparatus for the manufacture of elastic surgical stockings, socks, knee-caps, belts, bands, or other articles.* Dated Oct. 29, 1861.

Here the elastic thread of India-rubber, which is covered previous to working with silk, cotton, or other fibre, is laid in between the frame needles of the machine needles by an additional set of carriers, being regulated at each end of the machine according to the length of rubber intended to be laid on the needles. These rubber carriers are placed in front of the frame, and above the needles, and in addition to the carriers which lay the threads of which the fabric is made, the rubber carriers are dipped below the needles at each selvage until the course is finished, and they are required to lay again the rubber on the needles. Below the needles in front are two other sets of carriers, in addition to those named above; the carriers of one such set which stand in front lay on the needles a fining thread to be worked with each alternate course in the leg of a stocking, and the carriers of the other set, which lie between the last named set and the needles, lay on the needles a fining thread for the heel, the carries of both these last named sets being regulated as required at each selvage. *Patent abandoned.*

2710. R. Gibbon. *Improvements in machinery or apparatus for preparing grain for brewers.* Dated Oct. 29, 1861.

The patentee claims, 1, the general arrangement of two or more sets of rollers, with separating sieves and other apparatus combined in one machine, as described, for preparing grain for brewers. 2. The construction of crushing rollers and their bearings of machines for crushing grain of chilled cast iron or steel. 3. An arrangement preventing the back lash of the crushing rollers, when running empty, of any description of machine for crushing grain. 4. The construction of a weighing apparatus, having a set of figures or other references marked on the lever or bearer, for indicating the weight and specific gravity, and other particulars of barley and malt. 5. The construction of a regulating "butterfly" valve for regulating the supply of grain to the feed roller. *Patent completed.*

2711. J. Eaglesfield. *Improvements in gas-burners.* Dated Oct. 29, 1861.

This consists in placing a triangular or other shaped piece of iron, or other material, immediately above the apertures of an ordinary fish-tail burner, so that the flame of gas as it rises is split into two parts, and passes up on each side of the bar of metal; the flame unites again some little distance above the splitting bar. The effect of thus splitting the flame is to cause it to burn with little or no blue, and therefore to produce better combustion, and give a much greater light for the quantity of gas consumed than would otherwise be the case. The patentee raises one or two little brackets from the burner on which he fixes the triangular bar in a horizontal position with an apex or angle downwards, so as to present a cutting or splitting edge to the issue of the gas, the cutting edge being disposed some little distance above the hole or holes of the burner, so that the jet or jets of gas impinge fairly against the cutting edge. *Patent completed.*

2712. J. S. Jackson. *Improvements in the treatment of woven fabrics known as cords.* Dated Oct. 29, 1861.

This consists in submitting the fabric, before or after it has been finished, to a rubbing or impressing action, transversely to the direction of the cords, and by a surface with indented portions, so as to constitute a tooth similar to a comb. *Patent completed.*

2713. M. Scott. *Improvements in hydraulic presses.* Dated Oct. 29, 1861.

For many purposes hydraulic presses are required during a portion of their stroke to exert but a comparatively small amount of pressure, whilst for the latter portion of the stroke a much heavier pressure is required. In such cases the inventor employs a compound press consisting of two or more concentric cylinders; the innermost cylinder is fitted with a ram like an ordinary hydraulic press, and the cylinder is closed at bottom, and is made itself to serve as the ram of another hydraulic press formed with the next concentric cylinder, and this may in turn form the ram of a third press. When the press is set to work, the water from a force pump is directed first into the interior cylinder, and as this is of small diameter, the ram therefore rapidly rises, but the pressure will be comparatively light. As soon as this pressure proves sufficient, a cock placed in the supply pipe of the inner cylinder is closed, and another cock is opened, so as to admit the water from the force pump to the second cylinder, and in this manner the ram of the second press, which is the cylinder of the first, is raised, carrying its own ram with it, this being unable to descend, being blocked by the water enclosed beneath it. When the second cylinder is brought into work, the action of the press will be slower, and the force exerted will be greater in proportion as the sectional area of the ram of the second press (on the cylinder of the first) exceeds the sectional area of the ram of the first press. *Patent abandoned.*

2714. J. Hayward. *Improvements in raising water or other fluids.* Dated Oct. 29, 1861.

This consists essentially in the use of two tanks or reservoirs capable of being rendered airtight by a suitable arrangement of cocks and pipes, and whereby, by producing a vacuum, or partial vacuum, water may be raised for a variety of purposes. *Patent completed.*

2715. J. H. Johnson. *Improvements in machinery for enamelling moulded surfaces.* (A communication.) Dated Oct. 29, 1861.

This invention relates to a peculiar construction and arrangement of machinery or apparatus for applying enamel to the surface of wood mouldings in the process of preparing them for gilding, as well as for the purpose of making an enamelled surface upon all material capable of being heated in this manner. The essential features of this invention consist in the employment of a plate, the lower edge of which is formed or shaped the reverse of the transverse form of the moulding to which it is applied, when such plate is made self-acting to the surface of the moulding whilst being traversed longitudinally over it. Also in the employment of a hopper, or other suitable receptacle to contain the enamelling composition, having the lower edges of the two end plates thereof formed or shaped the reverse of the transverse form of the moulding to be enamelled, such moulding constituting at the same time the bottom of the hopper or receptacle. *Patent completed.*

2716. J. H. Johnson. *Improvements in the preparation of treatment of skins and hides.* (A communication.) Dated Oct. 29, 1861.

According to this invention the skins and hides are to be submitted to a kneading, fulling, or other similar process, and whilst undergoing that treatment, are to be incorporated with a mixture of compounds of suitable fatty or oily acids, with suitable metallic oxides, in combination or in conjunction with the fatty or oily acids. The improvements further consist in the employment of silicates of the metallic oxides, or of the alkaline earths, in conjunction with the fatty or oily acids. *Patent completed.*

2717. B. R. Priestley. *Improvements in the manufacture of woven fabrics.* Dated Oct. 30, 1861.

Here the inventor uses a cotton or silk warp in its natural colour, or bleached or dyed, and the weft of the goods is worsted or worsted and cotton yarn carded or combed, and either bleached, dyed, or in its natural colour, and sprinkled or mixed with one or more colours of dyed or bleached cotton, silk, worsted, or wool. *Patent abandoned.*

2718. M. A. F. Mennons. *An improved composition for igniting lucifer matches.* (A communication.) Dated Oct. 30, 1861.

This igniter is composed of any of the solid resins, either fusible or soluble, combined in a certain manner with a proportion of amorphous phosphorous. *Patent abandoned.*

2719. M. A. F. Mennons. *Improvements in the construction of horticultural cases.* (A communication.) Dated Oct. 30, 1861.

This invention is not described apart from the drawings. *Patent abandoned.*

2720. E. Leigh. *Improvements in the construction of sailing ships and other vessels.* Dated Oct. 30, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2721. C. Boden. *Certain improvements in the construction of lamps.* Dated Oct. 30, 1861.

This consists in making the socket with a screw, which is screwed into a nut soldered to or otherwise attached to the bush of the lamp. The candle is held in the socket by a cap with a bayonet joint. *Patent abandoned.*

2722. W. Cowper. *Improvements in machinery for cutting and dividing wood into scantling or laths.* Dated Oct. 30, 1861.

Here the wood is secured upon a moveable table, similar to that of the machine for planing metals, the surface of the table being provided with narrow grooves in the direction of its length. The table is moved forward by suitable gear, so as to bring the wood upon it and under a series of disc knives or cutters, fixed upon a horizontal shaft which is placed above and across the table, the edges of the disc knives or cutters just entering the grooves in the table. The shaft carrying the disc knives is arranged to be rotated, and so that it can be adjusted in its height above the table. *Patent abandoned.*

2723. R. W. Winfield. *An improvement or improvements in the manufacture of pulley rods for curtains, commonly called "French pulley rods."* Dated Oct. 30, 1861.

Here the patentee makes the ends of the pulley rods of malleable iron. He makes the rod, or cylindrical portion of the pulley rod, of a tube or hollow cylinder of wrought iron, without any casing of brass. He connects the tubular portion or rod with the ends in the usual way. The pulleys or rollers are fixed in the pulley rod ends in the usual way. *Patent completed.*

2724. R. W. Winfield. *An improvement or improvements in ornamenting metallic bedsteads, and other articles of metallic furniture.* Dated Oct. 30, 1861.

The patentee claims ornamenting the said articles by the use of ornaments composed partly of glass or enamel, and partly of metal. The invention is not described apart from the drawings. *Patent completed.*

2725. W. Cook and H. Cook. *Improvements in printing telegraphs.* Dated Oct. 30, 1861.

This consists in preparing the paper upon which the message is printed with salt of manganese. *Patent completed.*

2726. E. De Bassano and A. Brudenne. *Improvements in the manufacture of stearine.* Dated Oct. 30, 1861.

The patentees claim converting any portion, or the whole of oleic acid contained in fatty matters, into elaidic acid in the concrete state during the process of acidification, by the use of sulphurous acid gas in the nascent state, and also carbonaceous and other substances, or highly oxygenated bodies having the property of producing sulphurous acid, the same constituting this invention. 2. Adding oleic acid to fatty matters during the process of acidification, for the purpose of obtaining solid matters of a good white colour, and easy to press, and for facilitating the conversion of oleic acid into elaidic acid as above stated, *Patent completed.*

2727. J. L. Norton. *Improvements in apparatus for raising water.* (Partly a communication.) Dated Oct. 30, 1861.

Here there is formed at the upper end of a pipe leading to the source of supply a chamber, and the opening of the supply pipe into the chamber is fitted with a ball valve. The top of the chamber is closed with a flexible disc, usually of leather, with a hole through it at the centre. In this bolt a metal ring is fixed, to which also a ball valve is fitted, opening out of the chamber. To the metal ring in the disc a rod is attached by which the centre of the disc may be moved up and down, deflecting the disc alternately in either direction. When the disc is deflected upwards, the capacity of the chamber is increased, and a partial vacuum formed in it; this is at once supplied by liquid entering the chamber by the supply pipe. When the disc is deflected downwards, the capacity of the chamber is diminished, and as the valve prevents the liquid returning into the supply pipe, it is forced to pass through the passage in the disc, raising the valve; it thus enters another chamber with a pipe for conducting the liquid to the locality where it is required. *Patent completed.*

2728. A. Topham, J. Topham, and J. Topham. *Improvements in the manufacture of lace.* Dated Oct. 30, 1861.

The patentees claim allowing the grip or embroidery threads to pass up and down in the fabric as the pattern may require, by so arranging the working of the machine that portions of the fabric may for a time be left unmade, and then afterwards, when the grip or embroidery threads are ready to return, may be separately produced and raised into the spaces previously left for them. They also claim the use of lifting threads for raising meshes requiring to be so treated to positions higher than the points can take them, viz., the lower edge of the line of work across the machine, such lifting threads being crossed under the mesh to lift it, and afterwards being uncrossed to again free them from the fabric as described. They also claim the arranging points so as to take meshes requir
raised higher than the lower edge of the l

across the machine to the extra height required, be it one, two, three, or more meshes. *Patent completed.*

2729. R. A. Brooman. *An improved steel button, and method of manufacturing the same.* (A communication.) Dated Oct. 30, 1861.

This consists in manufacturing a spherical steel button, with a shank, and in a single piece, without soldering. *Patent abandoned.*

2730. E. Watson. *An improved fastening for buttons, studs, solitaires, brooches, civil and military decorations, and other like articles.* Dated Oct. 30, 1861.

This improved fastening consists of, by preference, three bent pointed prongs or pointed hooks, set about equal distances apart round the back or inside of the button or other article. The prongs are inserted one after the other in the scarf or other garment to which the article is to be fastened. *Patent abandoned.*

2732. J. A. Fanshawe, and J. A Jaques. *Improvements in the construction of steam generators.* Dated Oct. 31, 1861.

The patentee claims constructing steam boilers with a series of distinct narrow water spaces or compartments combined together, and having convolute, curved, or serpentine flues or passages between them, for the purpose of increasing the length of flues, and thereby retaining the heated gases in contact with the sides of the water spaces for a longer time than heretofore, so as to enable the water in the boiler to absorb as much as possible of the heat from the gases from the furnace before allowing them to pass away into the atmosphere. *Patent completed.*

2733. G. Norman. *Improvements in the mounting of cots or cradles.* Dated Oct. 31, 1861.

This consists in causing cots or cradles to rock longitudinally, or from head to foot. *Patent completed.*

2734. J. A. Fanshawe, and J. A. Jaques. *Improvements in the means of securing the doors of railway carriages.* Dated Oct. 31, 1861.

Here the object is to prevent the doors of railway carriages from being opened while the train is in motion. This is effected by self-acting machinery placed beneath the carriage. *Patent abandoned.*

2735. G. Holcroft. *Improvements in blast furnaces for smelting ores.* Dated Nov. 1, 1861.

This consists in the application of additional tuyers, placed on a higher level than the ordinary tuyers, for raising currents of air to act on the charges in the furnace before they descend to the level of the ordinary tuyers. *Patent completed.*

2736. L. Thomas. *Improvements in rifled ordnance and projectiles.* Dated Nov. 1, 1861.

The patentee proposes to form the curved surfaces, of what character soever they may be, in both the cannon and shot identical. This identity will render the usual contact of the two bodies a contact of surfaces, thereby avoiding the inequality of wear and friction which accompanies any inequality of collision. He proposes that the surfaces of the shot and cannon which are brought into contact when the shot is fired shall radiate each to the axis of its own particular body. Any movement of the shot from the breech to the muzzle of the gun tends to the approximation of these surfaces, and to the concentring of the shot and cannon. Immediately these friction surfaces meet, the centring of the shot in the cannon is effected. The friction surfaces are reduced to the minimum area, and in wearing have no tendency to alter the primary conditions of the cannon and shot, and, therefore, have no deteriorating effect. *Patent completed.*

2737. D. Lang. *Improved moulded india-rubber boots, shoes, and other like articles.* (A communication.) Dated Nov. 1, 1861.

Here the inventor first designs the model of the foot, or other part for which the article is to be made, and then he also forms a mould corresponding with the external form of the article when moulded and finished upon the first named model. *Patent abandoned.*

2738. W. J. Williams. *An improved process for correctly transmitting the effect of the main levers in platform scales to the steelyard or weighing beam of platform scales.* Dated Nov. 1, 1861.

This consists in substituting two short cranks or angles of a form either similar to, or acting in the same way as, bell cranks or their equivalents, for the shaft or rocking lever generally used in platform scales, to convey the effect of the main levers, such levers being vertical to the steelyard or weighing beam. *Patent completed.*

2739. W. Clark. *Improvements in photographic albums.* (A communication.) Dated Nov. 1, 1861.

In photographic albums as now made, the pictures are difficult to remove. The inventor obviates this disadvantage by covering the projecting edge with a sheet of paper, which guides the picture card over the projection and prevents its catching. *Patent abandoned.*

2740. E. A. Malino. *Improvements in glass cases for the cultivation of plants and flowers.* Dated November 1, 1861.

These cases are constructed of wood, glass, and zinc, or other material. The frame and lower portion of the case are made of wood, the top and sides of single plates of glass, let in the wood framing as usual. The sides and top are connected together by screws or buttons, capable of being readily engaged and disengaged, so that the cases can be taken to pieces, and easily moved. The bottom of the case is made of wood, lined with steel, zinc, copper, or lead, so as to form a box or tray. A special feature here is the way the patentee heats the cases, and provides a suitable circulation of air in the interior. In the box or tray is fixed a tank, which is placed on one side, and made to extend about half the bottom of the case. The tank is fitted with heated water, as may be required according to the season. *Patent completed.*

2741. T. B. Whitehead. *Improvements in steam-boilers, applicable also to other vessels or chambers containing steam.* Dated Nov. 1, 1861.

This consists in an arrangement whereby the inventor is enabled to inspect the interior of a boiler or other chamber containing steam during its working condition. To this end he causes light, natural or artificial, to pass through an opening covered with glass, and he adapts another similar opening by which the interior of the boiler or other chamber may be inspected, and in order to increase the light he uses reflectors and condensers. *Patent abandoned.*

2742. J. Higgins and T. S. Whitworth. *Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.* Dated Nov. 1, 1861.

This refers, 1. to those carding engines which are provided with a roller or rollers furnished with cards beneath the "licker in," and has for its object facility of adjustment. 2. In a method of adapting the ends and axes to cylinders or rollers of carding-engines. 3. The invention relates to the slubbing or roving frame, and is applicable to those machines in which one of the cases is caused to swing upon a centre, or is otherwise shifted, and has for its object the gaining a correct position of the cones for a proper tension of the strap. The invention cannot be here described in detail. *Patent completed.*

2743. R. Mitchell and W. Bounton. *Improvements in the construction of scissors and shears.* Dated Nov. 1, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2744. R. Mushet. *An improvement or improvements in the manufacture of cast steel or of homogeneous iron.* Dated Nov. 1, 1861.

This consists in adding to and combining with cast-steel or homogeneous iron, during the process of manufacturing the said cast-steel or homogeneous iron, by whatever processes either of these substances may be prepared, a triple metallic compound or alloy, consisting essentially of titanium, manganese, and iron, containing also carbon, in order to improve the quality of the cast-steel, or of the homogeneous iron produced. And the inventor uses the said triple metallic compound in a similar way, when the compound has been previously partially decarbonized or wholly decarbonized in the manner described. *Patent completed.*

2745. M. Myers, and M. Myers and W. Hill. *Certain improvements in metallic clips or points for holding, connecting, and adjusting crinolines, and other like purposes.* Dated Nov. 1, 1861.

This consists, 1. in making metallic clips or connectors for joining or uniting crinolines, and for such like purposes, where the material is of a uniform width; and, 2, in making such connectors that they may be adjusted so as to suit the various widths of the crinoline, or other material required to be joined. *Patent completed.*

2746. A. Smith. *Improvements in producing or delineating ornamental lines and figures on metal and other surfaces.* Dated Nov. 1, 1861.

This relates to the application and use of a ruling machine, the invention of W. Smith, for which letters patent were granted 14th day of November, 1853, (No. 2639), and which is used in the ornamenting of scotch wood work, and known in the trade by the name of a "checking machine." This new application consists in operating with a cutting point in place of a mathematical pen, and by either straight or waved lines, producing ornamental figures upon metallic or other surfaces, chiefly with the view that these surfaces after being so ornamented, shall be either gilt or plated. *Patent abandoned.*

2747. R. R. Priestley. *Improvements in the production of cotton, worsted, or composite yarns* Dated Nov. 1, 1861.

This relates to the manufacture of yarn from worsted or cotton, in which an ornamental or parti-coloured appearance is obtained, and consists in mixing or sprinkling small portions of fibrous material upon the lap or fleecy web of worsted or cotton, during the carding or other operation, prior to its being spun into yarn. *Patent abandoned.*

2748. A. Smith. *An improved combined book-marker and paper-cutter.* Dated Nov. 1, 1861.

This combined book-marker and paper-cutter is made by preference in what is known as "Tartar work." A piece of wood shaped to the form of the intended knife is decorated with the Tartar patern, and another piece corresponding in shape to the handle part of the cutter is prepared in like manner. These two parts are super-imposed, and are riveted to a spring which is arranged between the pieces. *Patent abandoned.*

2749. M. Henry. *Improvements in steam engines and boilers.* (A communication.) Dated Nov 1, 1861.

Here the object is the construction of boilers and engines for employing steam at very high pressure, five times that of ordinary boilers. The boiler is constructed having a reservoir or reservoirs for containing steam and water at about the same temperature, of sufficient volume to constitute a reserve of heat and motive power, intended to keep up the pressure of the steam, and to keep the work of the engine regular, notwithstanding the reduction of pressure and irregularities consequent on the incidents of feed and combustion, and on the power expended. Also an arrangement of engine is herein proposed to be constructed for working steam expansively at very high pressure. *Patent completed.*

2750. W. B. Smith and W. Bennett. *Preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases which escape from stacks, chimneys, calcining houses, chemical and other furnaces.* Dated Nov. 1, 1861.

This invention consists in confining and preserving such gases, &c., so that they may be turned to valuable purposes. In order to effect this object, the flue, which is conducted from the back of the fire, must be carried on to a small case in which is a blast fan, from whence the flue is continued to a chamber, or if need be, to a succession of chambers. When the blast fan is made to revolve rapidly, it causes a draft in the flue, which can be regulated as desired, and which carries onward the smoke, the gases evolved during combustion, and the air which passes in to the fire, and discharges them into a chamber or succession of chambers where they are heated according to their nature, no air being allowed to escape but that which is harmless, and this is passed through a finely perforated metallic plate, or through a sheet of canvas or such like material which is affixed to the outlet from the chamber into which they are discharged. *Patent abandoned.*

2751. W. Worsley. *A self-acting railway signal.* Dated Nov. 2, 1861.

This invention consists in having a lever crank, or crank with a lever working on a pivot or axle in or on a frame, and so applied as to allow of the lever being struck and depressed on the passing of a railway carriage by means of a side arm projecting from such carriage to a proper distance, and at a proper level to strike and depress such lever as much as needful. The said projecting arm can be constructed either with a roller where it would strike the lever, or with a hinge to work up and down, and strike a pull working in an inclined slip groove attached to the said frame, so as to draw the chain referred to over a curved crank or wheel, and so put the machinery into operation. *Patent abandoned.*

2752. J. S. Brooks. *A new or improved back or chest protecting brace or braces.* Dated Nov. 2, 1861.

This consists in combining a back or chest protector with a brace or braces by connecting the two parts of the braces together by a piece of flannel, cloth, or other suitable material, which, when the protector is required for the back, covers the space between those parts of the braces which reach from the shoulders to the back of the article of dress to which the braces are attached, the braces not crossing each other; and when the protection is required for the chest, the said material covers the space between those parts of the braces which reach from the front of the shoulders to the front of the article of dress to which the braces are attached; as when the protection is required for the back, the parts of the braces do not cross each other. *Patent completed.*

2753. A. F. Yarrow and J. B. Hilditch. *Improvements in machinery used when ploughing, tilling, or cultivating land by steam-power.* Dated Nov. 2, 1861.

This invention consists in improved methods of combining winding barrels or drums with portable steam engines. In carrying out the first part of this invention the patentees mount two winding barrels or drums on a horizontal shaft or axle, which is situated on one side of a portable engine. Upon one side of each of these drums are bevel teeth which are made to gear alternately with two bevel wheels, which are driven by a bevel shaft, and at the upper extremity of this bevel shaft is attached a bevel wheel, which gears into a bevel wheel which is fixed on the engine-shaft. In the second part of the invention they key a large bevel wheel upon the horizontal shaft, which is situated on one side of the engine; they also place a barrel or drum upon each side of this wheel, to which they may be alternately connected. The horizontal shaft upon which the large bevel wheel is keyed is continued on towards the under part of the engine, where a bevel wheel is attached to it, which wheel may be thrown into gear with another wheel which is connected either to the driving wheel or axle of the engine, for the purpose of propelling the engine. In the third part of the invention, upon the horizontal shaft, they fix a large bevel wheel, which is driven by means of a smaller bevel wheel, which is fixed on a bevel or vertical shaft. The horizontal shaft may be continued back towards the back of the engine, and arranged to render the engine locomotive in a similar manner to the former case. *Patent completed.*

2754. J. C. Wilson. *Improvements in machinery or apparatus for the manufacture of sugar.* Dated Nov. 2, 1861.

This consists in a new and improved combination of the horizontal class of steam boiler, with steam engine connecting gearing and sugar cane mill, all united together on the same iron foundation plate or girders. It also consists in a novel and peculiar arrangement of bevel and spur gearing, by means of which the said combination, or others of a like nature, can be most conveniently effected. The invention is not described apart from the drawings. *Patent completed.*

2755. T. Walker. *Certain improvements in the construction of cables or chains for telegraphic and other purposes, and for machinery connected therewith.* Dated Nov. 2, 1861.

This invention consists in using pieces of iron or other metal pipes, and joining them together with certain joints, so as to form a continuous chain of any desired length; by passing an insulated telegraphic wire or wires through the pipes, communication can be effected and continued across rivers, seas, oceans, or other places. *Patent abandoned.*

2756. J. Wright. *Improvements in the method of separating foreign matters from the droppings from carding machines, and for returning the residue thereunto.* (A communication.) Dated Nov. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2757. J. French. *Improvements in machinery or apparatus for doubling or twisting yarns of worsted or other fibrous substances.* Dated Nov. 2, 1861.

The object of this invention is to prevent the present waste of yarn, and the production of bad or imperfect yarn, which is now the case when any of the ends or threads break in the series that are being twisted together. To accomplish this the patentee applies a series of catches, so arranged as to act upon and stop the rotation of the whole series of bobbins immediately on the breakage of any of the threads, and thus break the whole number of ends which are being twisted together at nearly the same time. *Patent completed.*

2758. B. Brown and R. Hacking. *Improvements in machinery for preparing cotton to be spun, known as openers, scutchers, and carding engines.* Dated Nov. 2, 1861.

One of these improvements consists in placing between the roller, known as the doffer and the cylinder, in carding engines, other two rollers, containing teeth on their circumferences, for the purpose of stripping the cylinder more effectually. The roller next to the cylinder has a circumferential motion greater than the circumferential motion of the cylinder, which enables it to strip the cotton from the said cylinder, and the teeth of the roller having their points bent in the direction of the rollers' motion, also facilitate the stripping. Another roller having a circumferential motion greater than that of the roller before named, and revolving in an opposite direction, its teeth being bent in a similar manner to the one before named, strips off the cotton from the first roller, and conveys it to the doffer, the revolutions of which are regulated as may be required. The patentees also place fluted rollers underneath the rollers lying between the cylinder and the doffer, for the purpose of acting on the cotton to remove any superfluous matter contained therein. They also place under the said fluted rollers a band of cloth, which passes over the rollers, the object being to clean the fluted rollers. A revolving brush cleaned by a comb fixed near it, is used to keep the band of cloth free from any matter that may adhere to it. *Patent completed.*

2759. S. Osborne. *Improvements in hooped skirts.* Dated Nov. 2, 1861.

This invention consists in connecting the hoops forming the skirt by tapes or ribbands, carried diagonally in opposite directions from the upper to the lower part of the skirt, in such manner that the tapes running in one direction shall cross those running in the opposite direction. The patentee terms this "diamond lacing," and he finds skirts so constructed are more steady and have not that tendency to "wag" which belongs to skirts in which the hoops are otherwise connected. *Patent completed.*

2760. T. Lockia. *Improvements in the manufacture of wrought-iron wheels.* Dated Nov. 2, 1861.

This invention consists in forming wrought-iron wheel spokes with forked shaped heads, and welding the same upon a central ring (as described). *Patent completed.*

2761. G. Evans. *Improvements in treating peat to render it useful as fuel, and for illuminating and metallurgical purposes.* Dated Nov. 2, 1862.

To attain the object of one part of this invention the patentee combines with saturated peat other matters of a dry and absorbent nature, and which, by abstracting its water, so alters its character that the body or mass so formed can be readily compressed and moulded into shapes of any required size, while the materials so added do not injure the qualities of the peat, but rather improve them. For the production of illuminating gas he takes the crude oil obtained from coal, coal tar, the oil extracted from bituminous shale, petroleum oils, and incorporates them with peat, adding, if necessary, a small quantity of caustic lime to facilitate the extraction of the water, and render more perfect the amalgamation of the peat with the oils, and in this manner he produces a substance from which gas for illuminating purposes can be obtained in great abundance. *Patent completed.*

2762. S. W. Worssam. *Improvements in machinery for cutting wood.* Dated Nov. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2763. T. Spencer and T. Robinson. *Improvements in machinery or apparatus for making pipes and other articles of earthenware, and in the form of pipes for gas, sewage, and other purposes.* (Partly a communication.) Dated Nov. 2, 1861.

This invention refers to those machines in which the direct action of steam or other fluid is employed for forcing the plastic material through or into dies, and consists in the employment of an additional power, whereby the patentees are enabled to maintain the pressure after the moulding has been effected, and to work with a less pressure of the fluid. Another part of the invention relates to making articles of earthenware by a plunger, which is forced into a mould, and consists, 1, in covering the said plunger or mould with cloth or other such material, which may be peeled off, and, 2, in giving the said plunger a roughened surface. Another part of the invention relates to making pipes or other articles with a socket or other design at each end. Another part relates to a particular form of pipe for gas and sewage, which pipes they make with an enlarged part at one end, within which there is a recess, and the other end with a part capable of fitting into a similar recess upon another pipe, and they prefer so forming the ends that the interior diameter shall not be interrupted with projections.

2764. J. Bowden. *Certain improvements in dyeing and in apparatus employed in dyeing.* Dated Nov. 4, 1861.

In performing this invention the inventor employs a vessel provided with a perforated column through the centre, and with a grate near the bottom on which the fibrous to be dyed are placed. This vessel is connected by pipes to the vessels containing the mordant, the fixing liquor, and the dyeing mixture, and all the vessels are connected to a steam pipe. After the process of fixing, the articles under operation may be washed, and then the dyeing mixture is forced into the first vessel until the process of dyeing is completed. *Patent abandoned.*

2765. J. C. Anderson. *Improvements in apparatus for projecting cricket balls with accuracy.* Dated Nov. 4, 1861.

This invention is not described apart from the drawings. *Patent abandoned.*

2766. J. Archer. *Improvements in certain kinds of weighing machines, balances, and scale beams.* Dated Nov. 4, 1861.

This invention relates to weighing machines, balances, or scale beams in which, as ordinarily constructed, the beam turns upon fixed bearings on the top of the column, or other fixed part of the frame or stand of the machine, or balance, or scale beam; and consists of a small rectangular vertical frame open at its top, which frame is provided at its upper end with centres by which it is hung or supported upon the bearings in the fixed frame or stand in which the beam ordinarily turns. The beam is placed in the frame, its knife edges resting on the hard curved horizontal planes in the said frames. The frame in which the beam turns is capable of an oscillating motion upon the fixed stand or support. The beam thus acquires a freedom equal to that of a suspended beam, and a blow or shock given to the fixed support or stand is not transmitted to the planes on which the knife edges of the beam turn. *Patent completed.*

2767. J. Stewart. *Improvements in the manufacture of cards for jacquard weaving.* (A communication.) Dated Nov. 4, 1861.

This relates to a system or mode of renewing the cards in jacquard weaving mechanism, so as to avoid waste of material. Under one modification two cards representing different colours are taken and the layers of paper which form the card are slightly separated at the corner. The layers of paper are then completely separated, and the layer or half of one card is cemented to the half of the other card. The two remaining halves of the cards are in like manner cemented together, so that the four parts form two perfect cards. *Patent abandoned.*

2768. G. Horton. *An improved construction of skate.* Dated Nov. 4, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2769. W. Clark. *Improvements in water meters.* (A communication.) Dated Nov. 4, 1861.

This invention consists in the arrangement, within a stationary cylinder, of two or more oblique bladed wheels, secured at suitable distances apart on a central shaft so applied as to rotate freely within the said cylinder, and two or more series of stationary spiral water passages surrounding the shaft in the spaces between the said wheels, such passages and the blades of the wheels being at angles of 45° or thereabouts to the axis of the shaft and cylinder, but their obliquity being in opposite directions relatively to the said axis, so that water passing through the cylinder may be caused to strike the blades of the wheels perpendicularly, or nearly so, to the faces thereof, by which system of wheels and passages the water as it passes through the cylinder is made to act on the several wheels in succession. *Patent abandoned.*

2770. W. T. Weston. *An improved spring and fastening, applicable to gates, doors, and other useful purposes.* Dated Nov. 4, 1861.

This invention consists in the application of a fastening to a straight rod or bar of hardened and tempered steel, thereby to twist or turn it so as to form a spiral, in order that in the continual effort to regain its natural position it may exert an action or force analagous to that exercised by springs of some other different constructions. *Patent completed.*

2771. J. Ashley. *Improvements in apparatus for attaching horses to carriages.* Dated Nov. 4, 1861.

An important feature of this consists in using very short shafts, which come only to the horses waist or middle, the harness being so arranged as to enable the horse to set more round to its work in turning, there being no shaft to obstruct it at the blade bone. *Patent completed.*

2772. R. Wilson. *Certain improvements in steam-hammers, and in valves applicable to the same and to other steam engines.* Dated Nov. 5, 1861.

This consists in an improved arrangement of valves and gearing for working steam hammers, by which the steam may be admitted both below and above the piston to which the hammer block or ram is connected, or only to the former when required. The improvements in valves for steam hammers and other steam engines consist in so constructing them that their area, and, consequently, the weight and power required for working them, are greatly reduced. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Jan. 7, 1862.

46. J. Tatham, Rochdale, machine maker. Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton and other fibrous materials.

Dated Jan. 8, 1862.

50. L. Wunder, Liegnitz, Prussia, merchant. Improvements in the manufacture and composition of soap, applicable especially for shaving.

Dated Jan. 18, 1862.

139. T. Roberts and J. Dale, Manchester, manufacturing chemists. Improvements in the manufacture of gunpowder.

Dated Jan. 28, 1862.

219. M. A. F. Mennons, 39 Rue de l'Echiquier, Paris. Improvements in the construction of looms for weaving. (A communication.)

Dated Feb. 8, 1862.

335. F. Tolhausen, C.E., 35 Boulevart Bonne Nouvelle, Paris. Improvements in the manufacture of tyres of railway wheels, and in apparatus for such purpose. (A communication.)

Dated Feb. 12, 1862.

365. F. Tolhausen, C.E., 17 Rue du Faubourg, Montmartre, Paris. Improvements in the construction of vertical steam boilers. (A communication.)

Dated Feb. 18, 1862.

426. H. E. Quant and G. H. Fisk, 1 High-street, Manchester, merchants, and W. Dawes, Bolton, engineer. Improvements in the method of, and apparatus for, securing the ends of steel or other materials used for crinolines.

Dated April 1, 1862.

909. W. Clark, 53 Chancery-lane, engineer. Improvements in kneading machines. (A communication.)

Dated April 4, 1862.

971. M. Walker, St. Benet's-place, Gracechurch-street, accountant. Improvements in breech-loading rifles and other fire-arms, and in ordnance.

Dated April 10, 1862.

1026. J. Lillywhite, Seymour-street, Euston-square, cricketing outfitter, and T. Nixon, Chelford, Chester, cricketer. An improved bowling apparatus for cricket balls.

Dated April 21, 1862.

1157. A. Marks, Cannon-street-road. Improvements in artificial feathers, applicable to certain ornaments of dress.

Dated April 22, 1862.

1166. T. Lea, Smethwick, and S. Smith, bellhangers. Improvements in burglary alarms or indicators.

Dated April 23, 1862.

1175. R. Jinks, 20 Upper King-street, Bloomsbury, window blind maker. Improvements in apparatus for suspending, raising, and lowering Venetian blinds, and for retaining them and other blinds, and also curtains and sun shades, at any required heighth.

1177. W. Moir, Manchester, gentleman. An improved instrument for ascertaining the specific gravity of liquids.

1178. G. N. Bates, New Basford, Nottingham. Improvements in dressing lace and other fabrics.

1179. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in lubricating apparatus. (A communication.)

1181. J. Price, Dundalk, Ireland, C.E. Improvements in spikes for railways and other purposes, and in the mode of manufactoring and securing the same.

1183. W. Fear, jun., Bristol, veneer cutter. Improved arrangements for joining the saw plates of veneer and other saws constructed in segments.

1185. J. H. Johnson, 47 Lincoln's-in-fields, gentleman. Improvements in apparatus for taking deep sea soundings, and for recording the speed of ships. (A communication.)

1189. W. E. Newton, 66 Chancery-lane, C.E., Improvements in the manufacture of imitation lace, net, or open-work fabrics. (A communication.)

Dated April 24, 1861.

1191. J. Endean, Locksfields, Walworth, brass-founder. Improvements in cocks, taps, and valves.

1192. W. Haggett, Sherborne, architect and surveyor. Improvements in locomotive engines and carriages for railways, part of which improvements are applicable to carriages and vehicles for tram and common roads.

1193. H. Wheatley, Hopton Mills, Mirfield, woollen manufacturer. Improvements in or applicable to the employment of steam for heating or drying purposes.

1195. W. D. Ruck, 8 Duke-street, London-bridge, merchant. The manufacture of grease from coal, tar, coal oil, creosote, or dead oil.

1197. G. Davies, Bellevue-terrace, Seven-sister's-road, Holloway, mat maker. Improvements in the manufacture of matting, and in apparatus for the same.

1199. J. F. Allen, New York, engineer. Improvements in slide valves and valve gear for steam engines.

1201. F. Dangerfield, Bedford-street, Westminster, lithographer. Improvements in lithographic or zincographic presses.

1203. J. Offord, Wells-street, Oxford-street. Improvements in carriages.

Dated April 25, 1862.

1207. P. Barnet, 164 Rue de Rivoli. Improved electric danger signals for railways and other cognate purposes.

1208. G. Richards, 2 Caroline-street, Bedford-square, esquire. Improvements in ordnance, and the manner of loading such with the charges and projectiles suitable thereto.

1213. R. P. Roberts, 3 Exeter-villas, Kennington-oval. Improvements in the preparation of paper for copying letters and other documents, and in the preparation of copying ink.

1215. J. Shaw, Liverpool. Improvements in steam and other power engines and indicators. (A communication.)

1217. C. Reed, Kintbury, Berks, esquire. A new method of treating the sorghum saccharatum or holcus saccharatus, in order to obtain saccharine liquor and pulp therefrom.

1219. A. Applegarth, Dartford. Improvements in printing in colours, and in apparatus to be employed for this purpose.

1221. W. Fisken, Stamfordham, Northumberland, presbyterian minister. Improved apparatus for cultivating land by means of steam power.

Dated April 26, 1862.

1225. D. C. Le Souef, Twickenham. An improvement in the manufacture of nails, bolts, rivets, screws, eyes, and split keys or pins. (A communication.)

1227. G. H. Law, 17 Rochester-road, Camden New Road, gentleman, Improved means for draining flower pots and other articles or things which require draining in the same or similar manner.

1229. E. Alcan, Coleman-street-buildings, merchant. An improvement in or addition to carding engines. (A communication.)

1230. W. Clark, 53 Chancery-lane, engineer. Improvements in collars, wristbands, and cuffs. (A communication.)

1231. S. and G. Cheavin, Boston, Lincoln. Improvements in filtering and purifying water, and in apparatus employed therein.

1233. A. Hoyle, Birmingham, tool maker, and T. Warwick, machinist. New or improved machinery for manufacturing hair pins and cottar pins, a part of which machinery may also be used for cutting off and pointing wires for various purposes.

1235. G. Bischof, jun., Swansea. Improvements in treating solutions containing copper and silver, or either of them, to obtain metallic copper and silver.

1237. A. Lester, Coventry, draughtsman and desingner. Improvements in the manufacture of the fronts or uppers of slippers, shoes, boots, and gaiters, and of mats, bags, fire screens, and various other articles which are usually made of ornamental or Berlin needlework.

1239. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in lamps for burning coal oil and other hydro-carbons. (A communication.)

Dated April 28, 1862.

1240. G. B. Goodman, 29 Baker-street, Portman-square, auctioneer. Improvements in machinery or apparatus for preventing accidents in or at mine shafts.

1241. J. Burnie, Castle-Douglas, Kirkcudbright, N.B., implement maker. Improvements in tobacco pipes.

1243. R. Vaile, Auckland, New Zealand. Improvements in propellers for ships and boats.

Dated April 29, 1862.

1245. G. R. Samson, 8 Old Chapel-row, Kentish-town. Improvements in valves or cylinders for wind musical instruments.

1246. H. P. Wells, engineer, Woodlane-house, Prospect-row, Woolwich. Improvements in screw clamps or cramps for joiners' and other work.

1248. J. E. A. Gwynne, Essex-street-wharves, Strand, engineer. Improvements in the construction of centrifugal pumps, and in the application thereof, parts of which improvements are also applicable to other pumps.

1253. J. Ross, South-parade, Brompton, millwright. Improvements in grinding stones or surfaces for grinding grain and other substances. (A communication.)

1255. J. Cliff, Imperial-potteries, Lambeth, manufacturer. Improvements in insulators for supporting telegraph wires.

1261. W. E. Newton, 66 Chancery-lane, C.E. Improvements in machinery for picking, burring, and cleaning wool and other fibrous substances. (A communication.)

Dated April 30, 1862.

1270. A. T. Mercier, Louviers, France, engineer. Improvements in weaving looms.

1274. H. Hickman, 2 Miller-place, Park-road, Dalston, gentleman. An improvement in the method of fastening ladies' crinoline skirts and other articles of wearing apparel, and elastic and other bands.

Dated May 1, 1862.

1290. T. Holmes, 15 Princess-terrace, Regent's-park, bootmaker. Improvements in the manufacture of military cartouches, portemonnaies, courier bags, letter bags, knapsacks, and other articles of a like nature.

Dated May 2, 1862.

1291. T. F. Griffiths, Birmingham, manufacturer. An improvement or improvements in raising or shaping sheet iron.

1296. O. C. Evans, 20 Church-street, Old Kent Road. A reversible attachment to a shaft or arbor for converting reciprocating rectilinear into rotary motion.

1298. C. Ashwell, Albany-road, Barnsbury-park, Islington. An improved safety fastening, applicable to the locks of doors.

1302. J. W. Gill, Woodfardisworthy, Crediton, Devon. Improved apparatus for turning up and pulverizing the the soil of land for cultivation.

1304. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved electrical apparatus, applicable to the lighting of gas. (A communication.)

Dated May 3, 1862.

1306. J. Brierley, Blackburn, Lancaster, borough surveyor. Improvements in the construction of fire plugs or valves to be used in extinguishing fires or for other purposes where water is required to be drawn from mains under pressure.

1310. H. G. Moffatt, Dalston, designer. An improved advertising medium.

1312. T. Snowdon, Stockton-on-Tees, Durham, consulting engineer. Improvements in the manufacture of steel tyres, hoops, and cylinders, and in furnaces employed therein, and applicable to the melting of steel generally. (A communication.)

1314. J. Herdman, Belfast, Ireland. Improvements in the manufacture of wrought iron, steel, or combined wrought iron and steel plates adapted for ship building and other purposes for which strength and lightness are required.

1318. J. Fowler, Leeds, engineer. Improvements in engines for hauling agricultural implements.

1320. W. E. Newton, 66 Chancery-lane, C.E. An improved method of joining boxes. (A communication.)

1322. C. Schlickeysen, Berlin, machinist. Improvements in machinery for moulding bricks, tiles, pipes, and turf.

1324. P. V. Lefebvre, 29 Boulevart St. Martin, Paris, chemist. Improvements in fountain pens.

Dated May 5, 1862.

1326. T. Parkinson, brassfounder, J. Norman, millwright, and R. Cottam, Blackburn, moulder. Certain improvements in the construction of furnaces for steam boilers.

1330. S. Barnett, 23 Forston-street, Hoxton, engineer. Improvements in helmets for divers.

1332. C. Binks, Parliament-street, Westminster. Improved methods of obtaining hydrogen gas and certain gaseous compounds of hydrogen and of carbon.

1340. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in steam generators. (A communication.)

1342. B. Cooke, Frathy-house, Anthoney, Devonport, contractor's agent. An improved construction of implement for cutting turf.

Dated May 6, 1862.

1344. R. Mills, Bury, machine maker. Improvements in washing, wringing, drying, and mangling machines.

1345. J. Clarke, Chilvers Coton, Warwick, schoolmaster, and J. Richmond, ribbon draughtsman. Improvements in looms for weaving.

1350. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the manufacture and production of minium or red lead. (A communication.)

1352. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the manufacture of soda and potash, and of their carbonates. (A communication.)

1354. W. Clark, 53, Chancery-lane, engineer. Improvements in cylinder printing apparatus. (A communication.)

Dated May 7, 1862.

1358. E. Bourdon, Paris, mechanical engineer. Improvements in the construction of blowing fans, which improvements are also applicable to centrifugal pumps for raising water and other liquids or gases, and for exhausting the same.

1366. R. A. Brooman, 166 Fleet-street, patent agent. An improved box and apparatus for containing and igniting matches. (A communication.)

1368. J. Combe, Leeds, engineer. An improved machine for spreading and drawing into slivers, flax, hemp, jute, and other fibrous substances.

1372. D. Marchal and A. C. De Wiart, Brussels. An improved method of preventing the destructive effects of vibration or jar on the permanent way of railways, and on the wheels, axletrees, and other parts of carriages, and the working and other parts of machinery liable to shocks.

Dated May 8, 1862.

1374. J. Hay, Troon, N.B., shipbuilder. Improved arrangements to facilitate the cleaning and repairing of ships' bottoms.

1378. W. Southwood, Kensington, C.E. Improvements in machinery for pulverizing ores and extracting metals therefrom, part of which is applicable to breaking stones.

1380. P. Tate, Park-terrace, South-street, Kennington, gentleman. Improvements in smelting furnaces. (A communication.)

1384. A. Kinder, 30 Cannon-street, engineer. Improvements in the manufacture of sheet metal.

1386. N. Thompson, Birmingham, merchant. Improvements in barometers. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

43. J. Higgins and T. S. Whitworth. Doubling cotton.

46. J. Tatham. Doubling and winding cotton.

56. H. Bessemer. Iron and steel.

58. H. Cook. Transmitting despatches. (A communication.)

59. C W. Siemens. Insulating and protecting telegraph conducting wires. (Partly a communication.)

75. J. Oates. Washing machines.

79. J. Kenyon and A. Horn. Signalling.

85. T. Scott. Steam engines.

86. W. Wilkinson. Ornamenting and decorating.

87. A. G. Southby. Preparation of pulp.

89. T. Gilbert, C. Gilbert, and T. Hadden. Manufacture of swivels for guns.

93. W. E. Gedge. Motive power. (A communication.)

96. G. Hewitt. Drain tiles.

103. M. Chadwick. Folding or plaiting cloth.

109. C. Hill. Lubricating compounds.

115. J. Ridsdale. Preparing sheet lead.

123. T. Myers and E. Myers. Preventing rust.

131. T. Emmot and J. Travis. Manufacture of velvets.

136. W. Tice. Gas regulators.

137. S. Dreyfous. Throstle spinning frame. (A communication.)

141. L. Barbat. Manufacture of hats.

144. W. Bouler. Sizing. (A communication.)

147. E. C. Nicholson. Preparation of colours.

153. H. B. Barlow. Counting and indicating. (A communication.)

220. A. H. Church. Preserving stone.

235. W. Clark. Disintegration and bleaching. (A communication.)

239. W. E. Newton. Printing machinery. (A communication.)

246. E. A. Rippingille. Engines.

259. W. and P. Walton. Wire cards.

310. C. Calow and J. W. Hirst. Slide valves.

338. M. A. F. Mennons. Treatment of coprolites, and other fossil phosphates of lime. (A communication.)

485. W. Johnston. Lamps and stoves.

659. E. T. Hughes. Furnaces. (A communication.)

719. J. Grant. Portable railways.

856. W. E. Gedge. Extinguishing fire. (A communication.)

1040. J. T. Grice. Twisted metallic tubes.

1145. E. Loysel. Locks and fastenings.

1190. C. E. Heinke. Helmets.

1214. J. Elder. Steam engines.

304. A. V. Newton. Electrical apparatus. (A communication.)

1378. W. Southwood. Breaking stones.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated May 16, 1862.

2908. R. A. Brooman.
2909. J. Schloss.
2915. J. C. Croxford.
2916. W. P. Bayliss.
2919. E. Peyton and W. P. Batho.
2923. J. H. Jeffs.
2924. G. H. Polyblank.
2933. R. De Clercq and E. Chazelles.
2938. E. Peyton.
2940. M. Henry.
2964. P. Cowan.
2980. F. A. Calvert.
2994. M. Henry.
3017. T. Stead and W. Higham.
3079. M. A. F. Mennons.
3080. M. A. F. Mennons.
3112. M. A. F. Mennons.
3135. A. V. Newton.
395. W. G. Valentin.
685. G. Ermen.
727. W. Clark.

Dated May 20, 1862.

2944. J. Weems.
2948. W. Bray.
2950. F. De Wylde.
2952. J. P. Hulard and L. G. Poupel.
2955. J. Ronald.
2957. W. Burgess.
2960. J. H. Johnson.
2968. G. Clarke.
2970. W. Sellers.
2975. W. Firth and R. Ridley.
2977. G. E. Donisthorpe and W. Firth.
2979. J. Standfield.
3000. J. M. Rowan.
3006. B. Pitt and J. J. Shedlock.
3181. T. Bourne.
131. J. A. Knight.
240. W. E. Newton.
668. W. H. Latham, and F. C. W. Latham.
722. J. Avery.
832. J. Wilson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1200. R. Gourlay.
1201. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.
1201. W. S. Thomson.
1213. J. Chatterton.
1214. S. C. Sheard.
1219. O. Allcraft.
1231. E. Charlesworth.
1242. R. Wilson.
1250. J. P. Budd.
1258. T. S. Creasey.
1318. T. Wilson.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1099. G. T. Bousfield.
1127. W. H. Tucker.
1133. F. W. Mowbray.
1134. T. Piggott.
1153. G. Collier.
1157. J. J. Meyer.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending May 17, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
2417	0 7	2432	0 6	2447	0 6	2462	1 5	2477	0 7	2492	0 10
2418	0 6	2433	0 3	2448	0 7	2463	1 3	2478	0 3	2493	0 3
2419	0 3	2434	0 3	2449	0 7	2464	2 9	2479	0 8	2494	0 6
2420	0 3	2435	0 7	2450	0 3	2465	0 3	2480	0 9	2495	0 3
2421	0 9	2436	0 3	2451	0 3	2466	1 2	2481	0 8	2496	1 6
2422	0 10	2437	0 3	2452	0 3	2467	1 6	2482	0 4	2497	0 10
2423	0 11	2438	0 3	2453	1 11	2468	0 3	2483	0 3	2498	0 1
2424	0 5	2439	0 6	2454	0 2	2469	0 3	2484	0 3	2499	[illegible]
2425	1 1	2440	0 4	2455	0 7	2470	0 10	2485	0 3	2500	0 10
2426	1 9	2441	0 4	2456	0 3	2471	0 3	2486	0 7	2501	0 3
2427	0 3	2442	0 9	2457	1 3	2472	0 3	2487	0 7	2502	0 9
2428	0 3	2443	0 3	2458	1 3	2473	0 10	2488	0 3	2503	0 3
2429	0 11	2444	0 7	2459	0 8	2474	0 3	2489	0 3	2504	0 10
2430	0 2	2445	0 3	2460	0 7	2475	1 1	2490	0 6	...	...
2431	0 3	2446	0 3	2461	0 6	2476	0 6	2491	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, May 22, 1862.

		£	s.	d.		£	s.	d.
IRON:								
Rails in Wales and North of England	pr. ton	5	0	0	to	5	5	0
Welsh Bars, in Wales	,,	5	5	0	,,	5	[illegible]	[illegible]
Staf. Bars, at the Works	,,	7	0	0	,,	7	5	0
,, Hoops	,,	7	10	0	,,	8	0	0
,, Sheets, Singles	,,	9	0	0	,,	10	0	0
,, Nail Rods	,,	5	15	0	,,	6	10	0
,, Boiler Plates	,,	8	0	0	,,	8	10	0
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2	10	6	,,	2	14	0
Do. No. 1, Good Brands	,,	2	11	6	,,	2	15	0
Scotch Bars	,,	7	5	0	,,	7	15	0
Swedish Bars, in London	,,	10	10	0	,,	11	0	0
COPPER:								
Sheet and Sheathing	per lb.	0	0	11	,,	0	0	0
Tough Cake and Tile	pr. ton	94	0	0	,,	0	0	0
Best Selected	,,	101	0	0	,,	0	0	0
Australian	,,	99	0	0	,,	0	0	0
South American	,,	0	0	0	,,	0	0	0
Yellow Metal Sheathing	per lb.	0	0	0	,,	0	0	0
STEEL:								
Swedish Keg	pr. ton	15	0	0	,,	0	0	0
,, Faggot	,,	16	0	0	,,	0	0	0
TIN:								
English, Block	p. cwt.	6	0	0	,,	0	0	0
,, Bar	,,	6	1	0	,,	0	0	0
Foreign, Banca	,,	6	5	0	,,	0	0	0
,, Straits	,,	5	17	0	,,	0	0	0
TINPLATES:								
Charcoal, I.C.	pr. box	1	7	0	,,	1	9	0
Coke, I.C.	,,	1	1	0	,,	1	4	0
LEAD:								
Pig, English	pr. ton	20	0	0	,,	21	0	0
,, Spanish	,,	19	10	0	,,	19	15	0
Common Sheet	,,	21	0	0		0	0	0
Ten ,, (Wimshurst's Patent) A special disct.	,,	33	0	0	,,	0	0	0
SPELTER:								
On the spot	,,	17	10	0	,,	18	0	0
For arrival	,,	17	10	0	,,	17	15	0
ZINC:								
English Sheet	,,	33	0	0	,,	0	0	0
QUICKSILVER	pr. btl.	7	0	0	,,	0	0	0

JAMES LAURIE, Metal Broker,
30 King William Street, E.C.

Digitized by Google

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 30, 1862.

OUR IRON NAVY.*

THIS is the title of a small pamphlet just published. The author is so modest in introducing his ideas—which, he says, "although crude, "may be deserving of consideration"—it would not be fair to criticize them very closely. But as a partizan of Government, he starts with an assumption against which we must protest. "*Improvements* (he says) in de-"fensive armour succeed each other with "such rapidity as to render it impossible for "the Admiralty to keep pace with the science "of the day. A most thankless and unsatis-"factory task it must be for the heads of our "naval affairs to find that their *conclusions* "*and mature decisions* of to-day are by the ex-"perience of another month found to be un-"sound, and that the naval structures resulting "from their best energies, and the assistance of "most competent advisers, prove to be at best "but partial successes, perhaps failures."

Now, we know nothing of the *improvements* here referred to; we have long been looking for their introduction in official quarters, but in vain; and if Captain de Hersey is better informed in the matter than we are, he would render an acceptable service in pointing out a single improvement in armour plating which has been adopted, or practically proved to be an improvement, by the Admiralty. We know of only one system—that of the Warrior—which is now acknowledged to be defective in every-one of its details. We must suppose the author alludes to *improvements proposed* by inventors, which, as an honest seaman, he concludes have been tested and adopted when found practicable; but he knows little of the cold shade of authority, which even disregards the recommendations of its own advisers. What he means by the "conclusions and the "mature decisions of the day," we are at a loss to comprehend. We have had a vast number of experiments, but no decisions, except to go on covering ship after ship with enormous, unwieldly plates, weakened by great holes drilled through them, insecurely fastened, and backed with wood to accellerate their destruction. Captain de Horsey is a bold man to assert as an established fact that "projectiles can be "made and used with safety, which at short "ranges will penetrate any thickness of "armour that sea-going ships can carry." Is this one of his *sound* conclusions? Up to this time experiment has proved only *one fact*—namely, the utter insignificance and weakness, as armour plated structures, of the targets fired at. It is a dangerous delusion to estimate the force of the projectile by the weakness of the plate or the structure. The penetrating effect of shot on iron plates is a problem which has yet to be solved.

Suggestions and opinions are carefully culled by Captain de Hersey from many sources (the American papers are the favourite authority), and we are informed that iron ships of great strength may be constructed on the hollow girder principle; that armour plates may be made a source of strength instead of weakness to the vessel; that thin plates in layers may offer greater resistance than thick plates, and rams may be very destructive, if made strong enough. These are points at issue which evidently perplex the Captain as much as they do his superiors, in the service of which he is a gallant member. He concludes, however, with a *resumé*, in which he has the candour to admit he has grave doubts whether the Warrior and Achilles class of war ships are not objectionable "on account of their extravagant size, great "length, unwieldiness," and bad steerage; whether Captain Cole's admirable cupola principle may not break down in action at close quarters, by being put *hors de combat*, and whether "the handiness of our heavy iron ships "may not be sacrificed to a preposterous length "in order to obtain an extra knot of speed."

In these doubts, which, in spite of the hesitation with which they are expressed, we take to be Captain de Hersey's honest conclusions, we cordially agree, and we are glad to have the authority of a thorough-going seaman, who understands the handling of a ship, in support of the doctrine maintained elsewhere in this magazine, that in the re-construction of our navy *power must not be sacrificed to speed.*

The following are the concluding paragraphs of Captain de Hersey's pamphlet:—

Capability as a Ram.—For the purpose of injuring or even sinking an opponent, by running into her, the beak should be about three feet below water, from whence the stem should incline in, so as to concentrate the whole force of the blow where the beak strikes. The efficiency of a ship as a ram will depend in great measure on her power of turning quick, which again, as a rule, increases as her proportional breadth, and may be said to be of as much consequence in action as speed, With ships of symmetrical dimentions the screw gives us a power and ease of turning previously unknown, more particularly at slow speeds—officers thoroughly conversant with the management of screw ships, well know that you may throw a piece of wood overboard at the gangway, and screw all round it without moving ten yards ahead or astern—considering how useful this quality is for action, and for entering an enemy's narrow harbour, I trust that the handiness of our heavy iron ships may not be sacrificed by a preposterous length, in order to obtain an extra knot of speed. For ships which are to fight in fleets, speed must not be over-valued. It is good for chase, and also for a manœuvre Englishmen happily seldom practise, but for general purposes half speed will be more likely used.

Sail power.—For foreign-going ships I cannot see any way of dispensing with masts and sails. There will be great risk in working them in these days of rifles, and when injured, the wreck will perhaps prevent the proper working of the guns and cupolas, or what is worse, foul the screw, but of this we must take our chance, trusting to active seamen and sharp axes, and if the screw be irreparably fouled, we must continue the action under canvas. But as far as our present experience extends, we must be able to keep the sea or blockade off an enemy's port under canvas, so as to husband our fuel for use when required. With a fair proportion of canvas, I see no reason why our iron plated ships should not, under canvas alone, at least equal deep laden merchant vessels in sailing qualities.

Pumps.—More powerful pumps by far are required for war ships. In action a ship could hardly escape some severe injury involving leakage. When one looks at the splendid pumps used for dock purposes (such as Gwynne's centrifugal), which will clear a dock of over 10,000 tons of water in three or four hours, it naturally occurs to one what an advantage a powerful pump, worked by the engines, would be in action. I believe a pump of the description I have alluded to might be fitted, without taking up an inconvenient space, and do fifty times the work of all the hand and other pumps now fitted to a ship put together.

Shot Plugs as holes will be made in iron sides, they must be plugged during the action, and it will be well for us to observe carefully the sort of crevice made and injury done by shot, and to endeavour to invent a ready appliance for stopping such holes, however large.

Preventer Rudder.—The most important part of a ship, viz., the rudder, is exposed to injury notwithstanding all our armour plating. I think a preventer rudder might be fitted with advantage in the dead wood before the screw aperture, with a forked head, so as to work clear of the screw shaft. Such a rudder would be inferior in its action to the regular one, but I think it would be a good substitute in case of damage to or loss of rudder; it would not be in the way of anything, and it would merely take the place of a quantity of useless dead wood.

All ships' rudders should, I think, be fitted with a tiller on the after part, about the water line, for use in case of injury to the rudder head, and perhaps it might be advantageous to have a simple method of disengaging the rudder from its head in case of the latter getting bent, or otherwise rendered immovable.

Resumé.—Our naval battles will eventually be much as they used to be. Ships will be shot through and made leaky—a shell will occasionally enter and do fearful execution—spars will fall and entangle the guns, perhaps the screw—boarding will be resorted to—ships will try to run each other down—all these and other such events will happen, and never will our officers and seamen have had more scope for their daring, skill and seamanship, than they will in our future battles, should we unfortunately have war. Upon these qualities, with a thorough knowledge of the management of screw vessels, and upon the handiness of our ships, will depend the issue of a naval engagement, rather than upon their speed or attempted invulnerability.

THE MISSISSIPI AND SPITHEAD FORTS.

THE Government organs, in Parliament and in the press, labour hard to neutralize the effect which the proved inutility of the Mississipi Forts for the protection of New Orleans is calculated to exercise on the Spithead Forts question. Now that we have the details of the naval operations which terminated in the surrender of New Orleans, the case is found to be so analogous in its features to a possible attack on Portsmouth harbour, that in order to diminish the aptness of the comparison, and weaken the force of the argument it affords against land forts for harbour defences, ingenious assumptions and perversion of facts are had recourse to. But the points established by the successful passage of the Federal gun and mortar-boats past Forts Jackson and St. Phillip, are so conclusive against forts, and so much to the purpose, that the circumstances of the contest only require to be plainly stated to leave no doubt on the matter. This we will do methodically, enumerating the facts one by one, so as to lay them fairly open to controversy.

1. The Federal gun and mortar-boats established a successful bombardment of the forts at a distance of two miles, without suffering or being exposed to any serious molestation from the Confederate guns. We mean by successful, that they threw shell of the largest calibre into the forts, and kept up continuously for five or six days a damaging fire, which, although it did not silence the batteries, damaged them considerably, and greatly annoyed the artillery-men serving the guns which commanded the river.

2. In the grey of the morning 20 Federal gun and mortar-boats passed by the forts, crossed their line of fire, and ascended the river above and out of the range of their guns.

3. The passage of the Federal flotilla past the forts, although covered by the haze of early dawn, was not a surprise, or even unresisted, because there was a chain boom across the river to be broken through, and immediately above and below it a strong fleet of Confederate gun-boats and floating batteries to be fought, which kept the Federal vessels more or less under the guns of the forts.

4. Some of the Confederate gun-boats were iron-clad, but in a very ineffective manner. The strongest—the Manassas Ram—was a vessel of small tonnage, of little steam power, covered only with railway iron, and armed with a single gun. Two months previously, she ran into a Federal vessel, and sunk her at her moorings; but the ram suffered so much injury, she never was in a condition to repeat the same exploit, and proved unequal to withstand

---

* Our Iron Navy. Suggestions for its Construction. By Captain Algernon de Horsey, R.N. London: Ridgeway.

the fire of the heavy-armed wooden frigate, Mississipi, which sunk her with a few broadsides. The floating iron battery was unfinished, and so unmanageable and incapable of manœuvring, that she also went down under the enemy's fire.

5. Some of the Federal vessels were partially protected, either with iron plates, or webs of chain cables suspended over their sides.

6. The Federal force afloat was greatly superior in number and size of vessels, and in armament, to that of the Confederates. The former comprised some frigates and corvettes, besides a large number of heavily-armed gunboats, and a powerful and well appointed fleet of mortar-boats. The best ships of the Confederates were small gun-boats.

7. The distance between the forts is 1,000 yards; the mid-range of their guns, 500 yards.

In examining the exploit of the Federals, with reference to the efficacy of the forts as an obstruction to their passage up the Mississipi, we may dismiss any consideration of iron-clad vessels on one side or the other, for it was not a determining, or even a prominent feature in the contest, beyond the fact that the passage past the forts became a more difficult task than if there had been no Confederate ships to contend against, and therefore it was an addition to the strength of the forts, and made them more capable of protecting New Orleans. To state the case with precision, it was an affair between a flotilla making an attempt on New Orleans, and two advanced forts advantageously situated opposite each other, to defend the passage up the Mississipi; the attacking force having the disadvantage of not possessing any effectively protected iron-clad vessels, and the forts the advantage of a chain boom across the river, and the support of a fleet which, although inferior to the enemy, was of sufficient strength to carry on a contest with the invading force during a part of two days.

The result, therefore, affords the strongest argument against forts. Notwithstanding the odds against the attacking squadron, it crossed the line of the forts, which were well armed with the heaviest ordnance used in any service, and having overcome the resistance afloat, it ran up the river to New Orleans, and placed the city and the port at its mercy.

Pursuing the analogy as applicable to Portsmouth Harbour, of what possible use can the Spithead Forts be in the event of an attack from the seaboard, even if the attacking force consisted of wooden vessels, and the other circumstances of the case even similar? But they are not similar, for in the most important feature they differ widely. The Mississipi Forts are 1,000 yards apart, the Spithead Forts, if erected, will be 2,000 yards distant from each other. This important difference against the Spithead Forts has been pointed out by Sir Frederic Smith at the right time, and the country is indebted to the gallant officer for raising this question, "What will be the effect of "the heaviest projectiles on iron plates at "1,000 yards, which is the mid-range between "the sites of the two proposed forts?" He sagaciously referred to the fact that the Iron Plate Committee, in their experiments, finding that at a range of 500 yards no impression could be made on iron plates, reduced the range to 200 yards. We may anticipate what the effect will be at 1,000 yards.

It has been ascertained that the velocity of projectiles diminishes so rapidly at ranges exceeding 500 yards, that not the slightest impression would be made on the armour plates of efficiently iron-clad vessels, a fleet of which, therefore, at a distance of 1,000 yards, might pass by the guns of the forts unmolested, and oblige Portsmouth to surrender at discretion, unless it were defended by armour-plated ships of equal force to those of the assailants.

Argue, shift, and turn this question any way—mis-state, misrepresent, or mystify the incidents of the Mississipi contest—the facts we have enumerated are indisputable; and supported by the results of our own experiments on armour plates, they prove incontestably that fixed forts are not of the slightest use against iron-clad ships. They are useless simply because they are stationary, and have no choice of range. But floating batteries, which are moveable, and can meet or follow up iron-clad ships, and fight them, if needs be, muzzle to muzzle, will, if powerfully armed, be effectual and reliable coast defences. It would be wanton folly, or a corrupt job, to spend the people's money on the construction of the Spithead Forts; and it will be a culpable neglect of the best national safeguard if a number of powerful floating batteries and handy iron-clad fighting ships are not built with the least possible delay. Let us have improved Warriors and sea-going iron-clad cruisers. For these there is time; but for the coast defences not a day is to be lost.

It will be impossible for the House to come to a conclusion on the Spitheads Forts until Sir F. Smith's proposal for target trials at long ranges has been complied with. He has laid his finger on the point to be determined. Let him press his advantage; and if ministers hesitate to pledge themselves to carry out the proposed experiments at long ranges, let him go to the vote on that question, and it will be carried by a large majority. The debate on the Spithead Forts must be adjourned until these experiments come off.

THE GOVERNMENT AND IRON SHIPBUILDERS.

SOME correspondence of a very important character, as regards the owners of iron ships, has recently been published. It seems that there has, in past times, arisen considerable inconvenience to shipowners from the fact that the Government entertained objections to the employment of iron vessels for the conveyance of troops from port to port. In reference to this question, Mr. Laird, on the 14th of March last, addressed a letter to the Secretary of State for India, and mentioned a case in point. It had been required to charter a vessel at Calcutta some time previously for the transportation of troops to England, and the agent of Mr. Byrne, of Liverpool, had tendered an iron ship, lying in the Hooghly, to the authorities at Calcutta. This vessel was, however, rejected on the ground that it had been forbidden by the Secretary of State for India to employ iron vessels when wooden ships were obtainable. As such a vessel was at hand at Calcutta, Mr. Byrne lost the contract.

In reply to Mr. Laird's complaint, a letter, signed T. G. Baring, reached that gentleman on the 19th of March, and this, after asserting that no such prohibition as that complained of had issued from the Secretary of State, proceeds to say that some medical and sanitary objections existed with regard to the passage of troops in iron ships unless lined with wood, and especially within the tropics. The communication of Mr. Baring concludes with the satisfactory announcement that "arrangements have since "been made by the Government of India for "sending troops and invalids from India to "this country by the iron screw-steamers, "Hydaspes, Indiana, and Lady Jocelyn."

Mr. Laird, scarcely satisfied by this assurance, returned to the charge on the same day that he received Mr. Baring's letter, and concludes his own thus:—"You will, I think, "admit that the owners of all first-class "iron ships should have the opportunity of "tendering for the conveyance of troops, and "that such permission should not be confined "to any particular company or individual." A reply from Mr. Baring, on the 31st March, assures the persevering shipowner that "his "communication shall be brought under the "notice of the General Commanding-in-Chief." Thus the matter rested until the following gratifying communication, under the hand of Mr. Baring, reached Mr. Laird:—"The Gene"ral Commanding-in-Chief sees no objection "to the use of *iron* ships as transports, and "H.R.H. is of opinion that the owners of such "ships sheuld have the opportuntiy of tender"ing them for the conveyance of troops equally "with the owners of wooden vessels." An intimation that the concession shall be made known to the Government of India concludes Mr. Baring's last letter. A communication from Sir Richard Airey, Quartermaster-General to the Under Secretary of State, concludes the correspondence on this subject; but this is not important after our summary, and we omit further reference to it.

We cannot help congratulating iron shipowners upon the clearing up of a doubtful and vexatious point, and the complete opening of troop-conveying contracts to all comers who have sound ships, whether of iron or wood.

There are some dawnings of improvement as respects the iron trade of England with the United States. Mr. Griffiths remarks, in his circular, in reference to South Staffordshire, that we have had considerably more orders for iron from New York this week. The stocks at all the marts in the States are reduced, and all the houses here who have establishments in America, speak more favourably of the iron trade. There is an enquiry afloat for the American Government for 2,000 tons of armour plates, which can be made with ease by the mills of South Staffordshire. Our own Government, too, have made this week enquiries for plates to cover the two vessels now on the stocks. The peculiar feature of the market is the increased tendency to firmness for all kinds of hæmatites. Native mine pigs are fetching quarter-day prices. Cinder, forge, and melting pigs are flat.

We are of opinion that these symptoms, so far as America is concerned, are premonitory of returning healthfulness, and that soon the iron trade with that country will regain its wonted vigour, not only as touching armour plates, but generally.

THE INTERNATIONAL EXHIBITION.

THE EASTERN ANNEX.—CLASS II.

THIS class, with classes 3 and 4, were amongst the first to show signs of completion; and notwithstanding the heavy goods of other classes passed through the annex, until the last moment, under the energetic and skilful management of the superintendent, Mr. Quin, and Mr. Thomas, his assistant, no class showed itself more ready to receive its visitors on the opening day. Trophies do not seem to be in favour; yet a good word must be said for the principal product in the trophy in this class.

Alum, in technical phraseology, is sulphuric acid, alumina, and another base, which is necessary to produce the beautiful crystalline form by which it is characterized; this base may be soda potash or ammonia. Only a few years since—indeed, we can scarcely say years—soda alum was the cheapest, from being composed of the inferior alkali; potash alum came next;

tized by Google

and ammonia alum was the most expensive of all—not only the most rare, but the best *par excellence*. Chemistry of the economic school has, however, wrought in this a vast change. Ammonia, from the ammoniacal liquor of the gas works (besides producing that valuable product, sulphate of ammonia) is at once distilled over into the solution of sulphate of alumina, producing a double salt, which crystallizes around the sides of the vat; the mother liquor, as the water would be called, is then drawn off, the staves forming the tub or vat are knocked away, and the produce is then ready for the market, at a much less cost than even the inferior of its companions, which are now scarcely in existence in our markets. Messrs. Spence's specimen, No. 605, beautifully illustrates the process of crystallization; and just reminding our readers that one of the cements of the present day consists of gypsum, saturated with this product before passing through its final ordeal of roasting and grinding, we leave the Metropolitan Alum Company, with Messrs. Spence and others, to the enjoyment of their honours, whilst we touch upon the other substances of which the trophy is composed.

Borax, or borate of soda, (made from tincal), so valuable as a flux, and well known in the composition of the Parian cement, appears in the guise of a serpent (though we do not see why) surmounting the alum, and supporting a terminal of sulphate of copper, commonly known as blue vitriol. Around the base of this trophy are samples of sulphate of iron, the well-known green copperas, and the ferro and ferrid cyanides of potassium, better known as red and yellow prussiate of potash; also a specimen of acetate of lead, and the latest arrival exhibited by Mr. Crooke, showing in a wonderful result of the spectrum analysis, the new substance Thallium, with its sulphide and oxide, and the materials from which they are to be obtained.

The anomaly of this trophy is that finer specimens of most of its constituents are to be seen in other parts of the class. Thus we find the most magnificent crystals of red and yellow prussiate of potash, in the case of the Hurlet and Campsie Alum Company, No. 535, and Bramwell and Company, No. 484. Of the prussiate of potash, we would remark that it fills a very important place in our manufactures. Albeit it is made from such apparently worthless materials as rotten wool, rags, hoofs, horn waste, or any other azotized organic matters. These are mixed with the impure carbonate of potash and iron filings, and, whilst being stirred with an iron rod, submitted to a red heat in close iron vessels, the whole is afterwards treated with hot water, filtered, and evaporated, when crystals are obtained of ferrocyanide of potassium. By passing chlorine gas through a solution of the ferrocyanide, the ferrid cyanide is formed, or by another process, too elaborate to describe here, cyanide of potassium is the resulting product so much used in electro-plating, gilding, and photography, the finest specimen of which may be seen in the case of Messrs. Hopkin and Williams, No. 530. Again, from ferrocyanide of potassium, or the yellow prussiate of potash and sulphuric acid, the deadly hydrocianic, or prussic acid, is formed, and prussian blue is an admixture of this same substance with a salt of iron.

We have already spoken of the utilization of the ammoniacal liquor of the gas works. This leads us to consider the truly marvellous results that have been developed in the new product, aniline, from coal tar. Not long since gas was the only product that was obtained from coal, of a profitable character. Coke could scarcely find a purchaser; tar was a bug-bear of defilement—ponds of it seemed to beg for a hiding place from the anathemas of mankind. Yet from this very tar have we now a series of most valuable and surpassingly beautiful results. Witness the crowns of dazzling beauty made from the acetate of rosaline, the crystals of which, when dissolved, form that brilliant colour, the magenta; in fact, so far as colours are concerned, a fairy-land of etherial blues, and deep rich crimsons, not to speak of violet, reds, and yellows, seem to have issued, at a touch of the chemist's wand, from the styx of all abomination, coal tar. Messrs. Perkins exhibit their beautiful blues, purple, and mauve, as also a jar of coal tar, from which they obtain twelve grains of aniline. On the opposite side is a similar jar, containing one grain of this highly dispersive and wonderful salt in water, producing in that infinitesimal quantity the colour that has been so much and so long the rage amongst the fair sex.

Messrs. Maule and Nicholson, the manufacturers of the resplendent crowns of acetate of rosaline just referred to, have the more abundant, if not the finest specimens, of the coal tar products, and apropos of the aforesaid crowns, we must not forget one acid that has been called in to aid their production—we mean the acetic acid. It must appear wonderful enough to the uninitiated to learn that their white wine vinegar is obtained, in the form of acetic acid, from the smaller branches of the oak and other hard woods, and yet more so to learn that it is now also obtained from that apparently useless material that has so long sought a satisfactory destination—sawdust. This dust now finds itself entering the mouth of a long retort through a hopper, is coaxed forward by an endless screw occupying the whole diameter of the retort, and brought under a heat that implies *destructive* distillation, thus parting with its volatile products, and leaving the retort at the far end fairly exhausted, it has the satisfaction, whilst assuming its sombre carbonaceous form, of having become the parent of the acetates, whose names are legion, and are of so great a commercial value amongst dyers, as also in chemistry and pharmacy. Sawdust also yields, at the hands of Roberts and Dale, some fine specimens of oxalic acid. The Mclinevythan Co. (case 566), as also Messrs. Wright and Francis, shew beautiful specimens of acetate (sugar) of lead; indeed, the acetates are exceedingly well represented in this class.

Passing by, though not without an acknowledgment of their usefulness, the thousand and one products that constitute our ordinary list of chemical and pharmaceutical substances, we halt ever and anon at the beautiful specimens of crystaology that has proved our chemists to have been on the *qui vive* in their contest for the palm with our Continental neighbours, and amongst these unique specimens we would mention those of the bichromate of potash by White and Co., and codeine by McFarlane and Co., indeed, a list made of even the most noteworthy would occupy far too much of our limited space, so we trust that our readers will find an early opportunity of forming their own estimate of the excellence of this department of our International Exhibition.

A vast improvement in quality and price is shown in the alkalies, especially in soda. Our readers may remember reading in their catechism of chemistry, in their youthful days, how that soda was made from the ashes of marine plants, but most of them know that now-a-days. Salt is the great source from whence we are supplied with this useful alkali. Salt is a chloride of the metal sodium; by pouring sulphuric acid upon it the sulphate of soda salt-cake is formed, and the chlorine set free.

This sulphate of soda is then furnaced with chalk and small coal, the sulphuric acid is thus exchanged for the carbonic acid, and an impure carbonate of soda is the result. Again, lime is made to supply its oxygen in exchange for the carbonic acid, and we have, as a final result, instead of salt (the chloride of sodium), soda (the oxide of sodium), at a price just one-half that of potash or pearl ashes, which are still made, as aforetime, from the ashes of marine plants. This manufacture is most ably represented by Muspratt, 571, Gaskell, Deacon, and Co., 520, Hutchinson and Earle, 537, and the Jarrow Chemical Company, 540.

Soda very appositely leads us to the grand discovery of Sir Humphrey Davy of its base, the metal sodium. This has, until lately, been seen only as a curiosity in the laboratories or in choice collections of the chemist. Judge of our astonishment to find that it may be now had for something like 3s. per lb. Exceedingly fine samples of this metal are exhibited by Bell and Co., of Newcastle, as also of aluminum. In connection with this metal, we may mention a new product, for the first time exhibited to public notice—the silicate of alumina—a beautiful crystalline substance resembling glass. It is formed by mixing two alkaline solutions of silica and alumina; from the great affinity of the alumina for the silica, a union is formed between them of a most permanent character. The bases in the mixed solution, however, showing a most energetic action in strong solutions when diluted with water have that action so retarded that they remain in the form of a liquid for some hours, admitting of many useful applications, such as the preserving of stone by induration, and the manufacture of artificial stones, which processes are exemplified in the case, No. 471, by Messrs. Bartlett Bros., of Camden Town, who are also manufacturers of very fine specimens of the silicates and aluminates of soda and potash.

Fecula or starch has been brought of late years to a most wonderful degree of perfection, and the palm is hotly contested by Berger, Colman, Jones, and the manufacturers at the Glenfield and Springfield Works. Suffice it to say of this product, we never saw finer samples than those exhibited by the manufacturers referred to.

Our artist colourmen seem to have outdone themselves in the superb collections they display. Windsor and Newton, Reeves, Rowney, and Newman, each and all deserve the highest praise for the skill they have shown as manufacturers, and the taste they have displayed as exhibitors. Their cases contain most valuable as well as most beautiful specimens, though the exceedingly great value of quantity should not lead us from a fair judgment of quality, a standard to which the afore-mentioned exhibitors, with others, have so ably and successfully aspired.

A very unpretending case, yet one whose contents are of the greatest importance in a sanitary point of view, is that of Cundy, of Battersea, No. 500. We cannot dwell upon it longer than to say that the permanganate of potash there exhibited is a most powerful and innocuous deodorizer and disinfectant; its oxidizing powers are beautifully shown by treating pure and impure water; with a small quantity of the fluid each water may be perfectly pellucid or clear; but if organic matter be in solution, it will instantaneously be oxidized and precipitated as a powder to the bottom, leaving the water colourless; but if nothing of the kind exists in the water, it remains tinged with the pink colour of the fluid, which retains its normal condition.

Smith and Co., case 604, exhibit an interesting collection of opium products. The opium eater would, we opine, gaze with bewilderment at the various products extracted from his quid, the narcotine, codeine, morphia, narceine, and meconic acid, each adding to the physicians' influence over the evils to which flesh is heir. A very nice collection of sea-weed products are exhibited by Stanford, of Worthing, proving the untiring research of the chemist into the most unpromising of substances; we may also, whilst so near the sea, call attention to the fish manure, exhibited by Whitworth, case 622. And the products used in sugar refining, in case 501, are worth something more than a glance, reminding us that the extreme whiteness of sugar is derived from the presence of the blackest of all substances, and the sweetest material in creation is made even more pure in its sweetness by contact with a property of grim death's, burnt bones. Our readers will find an interesting subject in the varnishes and their gums, fine specimens of which are exhibited by Wilkinson and Co., 623, Mander Brothers, 562, and others too numerous to mention. An instance of the efforts exhibitors have made to please the eye with even the most inartistic materials, is to be seen in the case of black lead exhibited by Chick, No. 514, which certainly exhibits a high degree of perfection in its manufacture.

Mr. R. Rumney, of Manchester, has very patriotically provided a collection of dyes and dyed fabrics, shewing the novelties and improvements that have been introduced since the year 1851. Splendid specimens of madder, garancine, and murexide, with an almost countless number of other dyes, are exhibited in class 2; and as to the gentlemen who have so skilfully and laboriously produced the more rare chemicals, their successes and laurels will be most appropriately discussed by a more technical journal than our own. We hope soon to see the north door opened to the eastern annex, which will prove a great addition to the comfort of the visitors from the Kensington side of the building, and introduce a far larger number of visitors to class 2.

LEVIATHAN WORKSHOPS.

MESSRS. J. DEFRIES AND SONS, HOUNDSDITCH.

THE products of British art and industry will be exhibited to many wondering eyes during the next five months at South Kensington. It may, therefore, be instructive to look occasionally at those great workshops where the skilful and patient toiler, the fertile heads, and the busy hands are fabricating the material which, as articles of beauty and utility, will be compared with the products of every land. It will certainly be gratifying to note the progress which the inventions of science, and the improvements in manipulation have made in our art manufactures. It is not only that modern luxury has been gratified, but the public is being educated in the perception of beauty of form, and harmony of colour, and articles of every-day necessity, designed under the influence of good taste, have been cheapened and multiplied.

As an instance, we would point to the establishment of Messrs. Defries and Sons, of Houndsditch. That firm has obtained a celebrity for the manufacture of glass chandeliers, and most of the large public buildings in Europe have been fitted up by them. Some fifteen years ago a glass chandelier was an article of luxury to be obtained only by the affluent. Fifty guineas was a moderate price for one; and under ten guineas nothing could be put together that was worth looking at. A really pretty and almost elegant chandelier may now be had for two pounds. No doubt this is chiefly due to the repeal of the glass duties in 1845; but it is also, in a great measure, the result of that trading enterprise, and the division of labour, which have brought so many things which were once costly within the reach of all.

Our object in visiting the establishment of Messrs. Defries was to inspect some chandeliers of exquisite design and workmanship, and witness the process by which they are constructed on the premises, from the rough pieces of metal as they come from the moulds of the glass maker. But finding a business of great magnitude, giving employment to nearly 400 persons, with counting-houses, warehouses, and workshops towering high above the surrounding neighbourhood, we spent a day in traversing the extensive premises and examining their vast contents, and will briefly describe what we saw, in the hope that it may be interesting to our readers.

The basement, which extends under the entire building, is the department where the flint glass is received, unpacked and sorted, and repacked again for shipping. The glass wares come chiefly from Birmingham, and are of every variety and form, from an egg cup to the most costly decanter. The shipment of flint glass and earthenware from this warehouse is immense, especially since the commercial treaty with France. The firm has now an establishment in Paris.

On the ground floor are the counting houses, the warehouse for goods for town delivery, and a warehouse for packing for the country. Abutting from these, in the rear, are several large sheds, which look as if they had burst from the main building from very plethora of flint glass and crockery. We have seen in some warehouses very skilful and artistic displays of ceramic art, but we have never seen such an immense aggregate of the commonplace and the beautiful, the fragile and the solid. Amid some very tasteful designs in earthenware, one is struck by the predominance of the old willow pattern, with its unmeaning hieroglyphics. We were informed that this is still in great demand for export, probably because the colour is generally pleasing, and the pattern well covered. We certainly noticed that in some other designs, not devoid of taste, the colour was faint, and the figures spare. We should think that it would make the fortune of a Staffordshire potter could he get another Flaxman to do for him what he did for Wedgewood, and adorn our common ware with something of art and beauty.

In the vicinity of these warehouses is a room for roughing globes for gas lights and lamps. This is done by fixing the globe on a lathe, and applying to it the points of a bundle of steel wire in the form of a brush. As the glass revolves, sand is applied to it, and it is thoroughly scratched until it obtains that appearance which deadens the light and protects the eyes. When taken off the lathe it is washed in a solution of muriatic acid. Adjoining this is the engraving room, where the figures are engraved on lamp glasses, wine glasses, and other glass for table use. This is perhaps the most skilful operation which made glass undergoes. The engraver sits opposite a copper disc, which is made to revolve by means of a lathe. The diameter of the disc is regulated to the fineness of the design required. For very minute designs the diameter of the copper disc is less than that of a threepenny piece. For large designs the disc is larger. Oil and emery are applied to the circumference of the disc, against which the artist holds the glass to be engraved, with more or less force. One would expect to see it fly in a hundred fragments; but the thing is done dexterously, and you can see that the glass has been scratched. A few more applications, and you begin to trace evidence of design; other repetitions, according to the figure to be produced, and you have the outline before you perfect and truthful. The delicacy of this operation will be apparent, when it is considered that there is no tracing to guide the eye, that the oil and emery have to be wiped off the glass at each application, and that a single wrong scratch would mar the whole design. The artist must evidently have a well educated eye, and can only attain perfection after much practice.

We now ascend to the first floor, where there are large show-rooms for cut glass of every variety, for use or ornament; tea and dinner services in china, porcelain ornaments of every description, and brass chandeliers. Beyond the variety and beauty of the goods displayed here, which we need not describe, as there is no process of manufacture, we may only remark, that, if the luxurious Nero gave £50,000 for a pair of crystal goblets, had he lived in our day he might have gratified his taste in this show-room for—we are ashamed to say how little by the side of his £50,000.

We mount another floor, and find ourselves among a variety of goods, especially cut-glass chandeliers, and candelabra, glorious in every prismatic colour. Here the full force of the speciality of the establishment is visible. The glass is of the purest, and the designs, from the pencil of an Italian gentleman, employed as artist by the firm, are the richest and most magnificent. Coloured glass is not employed, only the purest flint. Coloured glass drops and facets may, to the vulgar taste, have a more pleasing effect, but can never vie with pure crystal. Flint glass is peculiarly adapted for articles of luxury, such as goblets, chandeliers, decanters, &c., from the ease with which it is ground or cut, from its brilliant lustre, high refracting power, and perfect freedom from colour. The mass which is used for this purpose is called crystal, from its resemblance to rock crystal; it excels the Bohemian grinding glass with reference to refractive power and easy fusibility, though the latter is harder and more colourless. It is this diamond brilliancy of the brightest and purest flint glass that gives to the chandelier its greatest beauty; for where the light passes through a coloured medium, there must be absorbtion of certain rays, and a consequent loss of light and brilliancy. Coloured chandeliers look better by day than night, it ought just to be the reverse. The weight of some of the chandeliers in this room is immense. Messrs. Defries have put together a magnificent one in the Exhibition, which weighs over three tons. We see here also the model of a mirror manufactured for the Palace of the Sultan, formed entirely of prisms. The problem was to fill up a circular and arched alcove with glass, where it would have been next to impossible to adapt a large sheet of plate glass. By the model it is easy to judge of the splendour of the original.

One floor higher, and we have a room appropriated to the fitting and putting together of moderator and paraffin lamps. Here we see the piece-meal of the lamp which is within reach of the humblest artizan, to that which may burn in the saloons of Belgravia. All the parts of those lamps come from the factory of the firm at Birmingham. We notice that Messrs. Defries have 300 different designs of chandeliers; the varieties of the paraffin and moderlator lamps are endless.

We ascend another storey; and by this time we are far above the level of the street and the

Thames. Here the arms and drops of the chandeliers are put together, and here also are workshops for gas-fittings and workmen, who are employed in all matters having reference to street illuminations. By the way, Messrs. Defries have brought out a mode of illumination, through the medium of bright and stained glass, which will show itself in the gustiest night, as the gas jets are protected from wind and rain.

Once more we ascend. A side door is opened for us, and we enter a room filled with the most primitive of looms, and the most primitive of spinning and winding wheels. We are dragged back from modern inventions a full century. These looms and spinning wheels are more than two generations old. The looms weave cotton wicks for lamps, of every length and breadth. The winding machines are worked by lads, who fill bobbins for the weavers. It was with these humble machines that the late Mr. Defries commenced business some fifty years ago. He wove cotton wicks. He had a small stock of oil lamps. From this small beginning grew the house. Now the firm can supply lamps enough and wicks enough to light up the whole metropolis, and all the colonies. There are glass globes—"moons" they are called here—and chimnies, and other appurtenances to the lamp, packed away here sufficient in number to supply all the capitals of Europe, should there be any sudden demand through breakage. These looms and winding machines have an interest of themselves.

At length we attain the uppermost floor of the building. Here the glass cutlery or grinding is chiefly conducted. There are thirty lathes at work, and the treddles so span the floor that it requires wary walking to preserve toes and shins from injury. The glass forms to be ground are moulded in Birmingham and at Houndsditch. They arrive at the London manufactory in the rough; but the rough is speedily made plain. The artisan operates upon the hard metal with all the ease that a country boy operates upon a stick with his whittle. The rude edges he gets rid of with a file. We shall take for illustration the drop of a chandelier. It is now a rude, dim-looking dodecahedron. The workman applies facet after facet between his fingers to the surface of a disc of iron, over which is suspended a hopper supplying a constant flow of sand and water. This is process number one. The facets are then applied to the surface of a disc of Yorkshire grit stone, where the surface becomes a little smoother and brighter; and finally to a disc of hard metal, anointed with oil and rotten stone, when the "drop" comes forth from the fingers of the workman sparkling like a diamond. Cut glass passes through a somewhat similar process, except that the cutting is made by the periphery of the wheel; and the final touch is given by a disc of willow-wood or of cork.

We have hardly left ourselves space to notice several other interesting processes in this establishment. But we ought not to omit mention of one room, where light and tender female fingers are employed in fitting beautiful panes of stained glass into hall lamps—an employment adapted specially for women, where nimbleness and gentle handling are so much required. Females are likewise employed in many other of the departments. Altogether, our visit afforded us much information and interest.

The Magnet.—A *diamond* laid on a needle the loadstone will not attract it.

Painters' Colic.—*Prevention and Remedy.*—Mr. James Bruce writes to say that, "painters, when at work, cannot eat too much *lump sugar.* It neutralizes the poison of the lead."

TRIAL OF THE SCOTT RUSSELL TARGET AT SHOEBURYNESS.

A short time ago, the naval intelligence of a leading journal, introduced Mr. Scott Russell's system of naval armour to public notice, with an announcement that the plan was adopted by the Admiralty for armour plating a number of ships. For this, however, there was no foundation, but the intention of Government to try the plan by the construction of a target, which on Friday last received its baptism of fire at Shoeburyness. The attendance was not so numerous as on other occasions of target trials. The Lords of the Admiralty were absent; but there was a strong muster of engineers and manufacturers connected with iron ship building, as well as of naval officers, many of whom are keenly watching the development of the new art of naval construction, which is calculated to revolutionize the tactics of their profession.

A description of Mr. Scott Russell's plan was published in the Mechanic's Magazine on the 7th March last, and the probable result of its trial under fire was pointed out. It was shown that two sources of weakness existed; one, that the dovetailed ribs which form the frame fastenings round the edges of the plates are exposed to impact, and liable to fracture; the other, that this mode of fastening does not admit of the plates being drawn to a bearing, and therefore subjects them to be easily fractured by projectiles.

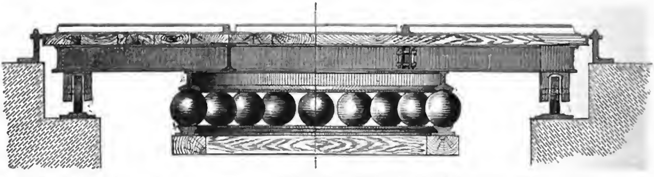
It is so important to comprehend the true causes of success or failure in these experiments, that we shall be excused for referring to observations previously published in our journal, as our object is to lay down principles and provoke discussion, as the only means of arriving at the truth.

The experiments on this target, which is 30 ft. long, and 10 ft. high, with two ports, were conducted by the Iron Plate Committee, in accordance with their usual programme, at 200 yards range. The 1st and 2nd rounds consisted of shell, some of which where 104-pounder Armstrong's, with 12lbs. charge, and some 49½-pounders, with 16lbs. charge, from 68-pounder guns. Of these projectiles five filled with sand and three live shell (two of the latter having missed the target) struck the second and third plates from the top between the ports. These hollow shot are never expected to do much damage to the plates, as they break up by impact and have no penetrating force. But, contrary to all precedent in former target practice, they fractured the two plates struck extensively. The iron of these plates was cracked in all directions, presenting the appearance of panes of glass broken by a heavy blow without being penetrated. This result proceeded evidently from the plates being simply supported in a frame, but not held fast to a bearing. The ribs holding the edges were also cracked through in several plates, and large pieces of the dovetailed heads which held the plates were torn off, exemplifying what was proved by former experiments, the inefficiency of any fastening exposed to impact. Inside but little damage was apparent. One ship frame was cracked, and two caulking plates, of which the rivets gave way, fell off. The Inventor expressed great satisfaction because the fastening round the edges was not entirely broken away, and he was entitled to that consolation as some compensation for the unprecedented manner in which the plates were split in all directions by hollow shot. The 3rd round, consisting of solid shot, 110 pounder Armstrong's, and 68 pounders, at Mr. Russell's special request, were fired (each shot singly) at the left end of the bottom plate between the ports, close to the foundation where the plate is supported behind by a longitudinal iron girder, and unquestionably is the strongest part of the target. This plate, like the two former, was cracked extensively, and fragments were torn away from the dovetailed rib frames, of which one was broken asunder. The shot made deep indentations in the plate. Externally there was no appearance of the plate being penetrated, but on examination of the back of the target the backing and skin were found to be broken through, so that the part of the target representing the frame of a ship was penetrated. The 4th discharge was a single 150-pounder solid shot from the great Armstrong smooth bore, with a charge of 50lbs., and it was, at Mr. Russell's particular request, directed at the lower part of the centre of the largest plate (12 ft. by 3 ft.), which it struck a few inches above the foundation, where the plate abuts against the before-mentioned longitudinal girder, from which it received an increased strength of backing extraneous to the inventor's system. To this circumstance is to be attributed the protection of the target from greater damage than it received at this point. The shot made a deep indentation in the armour plate; it split in two the upper rivetted frame rib of the plate which received the impact, and caused a long fissure in the plate above it, although it was not struck by the projectile. But the external appearance of the plate was no indication of the effect of the missile. An examination of the back of the target proved that the frame bar and backing behind the point of impact, and twelve to fifteen inches around it, were crushed in and broken into fragments. The fifth attack was with another 150 pounder solid shot, and a charge of 50 lbs. This missile again was aimed at Mr. Russell's favourite line of strength, close to the foundation against the lowest plate under the right port. Striking a little higher than the last shot, and consequently not receiving equal support from the longitudinal girder, it made a deeper indentation, and damaged the plate more extensively. The cone of the projectile remained imbedded in the iron, of which a piece twelve to fifteen inches in width was driven in three or four inches, the fracture exhibiting a deep crack round the shot and in other directions. The top and bottom frame ribs were split across, and the damage to the backing plates and ship's skin was greater than that produced by the preceding shot. This plate, in addition to the welded fastening round the edges, was secured by a line of large through bolts along the centre, well rivetted inside; but they only served to corroborate the fact proved by former experiments, that through bolts determine the cracks.

Another 150 pounder solid shot was then fired with 50 lbs. charge, and struck the joint of the first and second plates from the top, between the ports. It passed through the armour, the backing and skin plates, and caused an awful smash. The frame ribs were split across at three of the four corners, and the lower one was broken away twelve inches on each side of the point struck. Two deep cracks on the plate on either side of the shot hole, nearly two feet apart, and running from the lower edge to the top, where they met, separated a fragment of a conical form and about four feet surface from the body of the plate. At the back the destruction exhibited, considering the thickness of the opposing mass of iron, was greater than at any other target trial. The whole space between two series of ships' frames, thirty-six inches in width, and about the same depth, was completely smashed. In a vessel it would be an irreparable breach, and the destruction by splinters would be terrific. In our report of the trial of the Samuda target we described a similar catastrophe. The breach in the two cases was of about the same dimensions, but it must be borne in mind that the thickness of the Samuda panels, and therefore the strongest part of his target is only six inches, whilst that of the Scott Russell system is eight and a quarter inches of solid iron all over. The latter, therefore, is a more complete failure than the former.

The *finale* of the pounding inflicted on the target was a round of five solid shots—three 110-pounder Armstrong's, and two 68-pounders—which were fired at the second and third plates from the top, between the ports; every one of these projectiles told with damaging effect. Each made a deep indentation in the plate with an irregular circular crack around it, so that although the shot did not pass through the arm
effect was more damaging than if it had
as pieces, twelve to fifteen inches in di-

WARD'S PATENT SELF-CENTRING TURNTABLE.



broken out of the plate, and the momentum of the projectiles acting on the backing and skin plates, split them through and through, and drove the latter inwards.

The inventor, notwithstanding these disastrous results, seemed well satisfied. He expressed his confidence in his system, because the broken fragments of the plates and frame ribs, he contended, would still hold on and keep out the enemy's shot. We are, however, inclined to think that when this target is taken to pieces it will be found to be more extensively and fatally damaged than any other which has been tried.

THE IRON WALLS OF OLD ENGLAND.

We are obliged for want of space to postpone the publication of "A Civilian's" letter, No. 14, to next week. We do so with regret, as it contains an interesting analysis of the principles of different systems of armour-plating, including that of Mr. Scott Russell's, the trial of which is reported in another part of this impression.

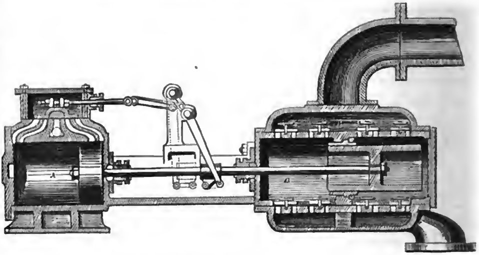
"Civilian" begs us to acknowledge the receipt of T. W's letter and model of his mode of fastening, with reference to which T. W. will receive a private communication. For the information of J. M. Callan, the Warrior was designed to act as a ram, and in her construction provision was made to fit her with a powerful iron beak, in the strongest part of her stem, calculated to produce the most destructive effect on an enemy's vessel. The Admiralty finally determined not to carry out that part of the design, but the foundation work for the conversion of the Warrior into a ram forms part of her structure, and the iron beak can be at any time added without difficulty.

WARD'S PATENT SELF-CENTRING TURNTABLE.

The accompanying engraving represents an engine turntable, constructed of iron without the central pivot, that requires less expensive foundation, is capable of sustaining any weight, with a free and easy movement in its revolution, and adapted to all localities or climates. This arrangement of turning platforms is well adapted for swing-bridges, mortar-beds, pivot-gun carriages, etc.

Manufactured and for sale by Lloyd's, Foster's & Co., Old Park Iron Works, Wednesbury, England; and in the United States, by the patentee, W. H. Ward, Auburn, New York.

LEE'S STEAM PUMPING ENGINE.



LEE'S STEAM PUMPING ENGINE.

This invention, patented by Mr. Wellington Lee, of New York, of "An Improvement in Steam Pumping Engines," relates to a novel or improved mode of arranging and working the valve gear of the steam cylinders of engines for pumping or forcing water.

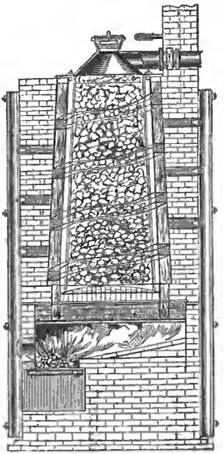
In carrying out the invention, two or more steam cylinders are arranged side by side or in any other convenient position, and the valve gear for working the valve of one cylinder is actuated or opened and closed by the movement of the piston of the other or contiguous cylinder. It will be found convenient in practice to arrange the working of the piston in such a manner that when one piston is at mid or half-stroke, the other piston shall be at the end of the stroke. The operation of the valves and the arrangement of the ports for the induction and eduction steam is also so contrived that the exhaust of the steam from the cylinder may be arrested at such a point of the stroke as will prevent the piston from over-reaching or striking against the heads of the cylinders. By this means the cranks, excentrics, and fly wheels usually employed in steam engines may be dispensed with; and when the invention is applied to pumping engines a more uniform and equal flow of water or other liquid at all points of the stroke is effected. The pistons will also be allowed to pause at the end of each stroke, thereby permitting the valves of the pumping cylinders to close more gently and with less shock than they otherwise would. The accompanying engraving is a longitudinal vertical section taken through one of the steam cylinders and valve chest, and one of the pumping cylinders, and the valves belonging thereto. *A* is one of the steam cylinders, of which there are two side by side; and *B* the pumping cylinders, fitted on one end of the piston-rods, and one of these pistons work in each of the steam cylinders; and *C* is a trunk piston fitted on the other end of the piston-rod, and working in one of the pumping cylinders. The valve of the steam cylinder is worked over the steam ports, by means of a stem, which passes through a suitable stuffing box in the end plate of the valve chest, and is connected at its outer end by means of a link to a vibrating lever on the rocking shaft. In connection with the other steam cylinder there is a similar rocking shaft, carrying at one end a vibrating lever, which through a link communicates motion to the stem, and the valve of the other cylinder. On the opposite ends of the rocking shaft are keyed two levers, which are connected at their lower extremities by means of links to the pendent arms of blocks which are keyed or otherwise secured near the middle of the piston-rods. It will be understood that on the advance of the piston in the steam cylinder *A*, the block on its rod will, through the intervention of the vibrating lever, cause the shaft to rock in its bearings, and push forward the valve stem of the other cylinder, and thereby open the valve of that cylinder, and *vice versa*.

TRIAL OF MERRYWEATHER AND SON'S PATENT STEAM FIRE ENGINE.

On Saturday last a private trial of Merryweather and Son's Patent Steam Fire Engine took place at Hodges' distillery, Lambeth, where an abundant supply of water and the lofty chimney shaft of the establishment afforded a good opportunity of testing this powerful engine. Steam was raised very rapidly, as it has several times been raised from cold water in the boiler to a pressure of 40 pounds per square inch in 10 minutes from lighting the fire. The engine was then set to work, and the jet through a 1¼-inch nozzle was projected clear over the lofty shaft to a height of 170 feet; a 1⅜-inch jet was then tried, and the water projected to a height of 157 feet; next a 1½-inch jet was tried, and through this large sized nozzle the jet reached over the shaft to a height of 150 feet. Tried horizontally, the 1⅜-inch jet was projected 202 feet, and the 1¼-inch jet 215 feet; the latter jet was sent clear over the gates of the distillery, and nearly half-way across the road.

A correspondent from the Federal army says—"Professor Lowe is on here with his balloon, and rendering invaluable assistance to the general in command. An ascent was made last evening to a height of 950 feet, and the Acting Adjutant-General of Franklin's division was enabled to distinguish clearly the camp fires of the retreating enemy at fifteen miles' distance.

EVANS' APPARATUS FOR GENERATING GAS.



THE object of this invention, recently patented by Mr. J. Evans, of the Chartered Gas Company's Works, is to expedite the manufacture of gas, and effect an important economy both in the manipulation of the process, and in the construction of the gas-generating apparatus. To this end, instead of using, as heretofore, a series of horizontal retorts, set side by side in a furnace, for generating a given amount of gas, a vertical retort of large capacity and of peculiar construction is used enclosed within a furnace or oven, and surrounded by a heating flue, which leads from the fire-place and rises spirally around the retort until it reaches the exit opening to the chimney. The above engraving in vertical section illustrates the construction. *A A* is the retort, which may be constructed of fire-clay or of iron, protected by a fire-clay covering on its outside. This retort is enclosed in a furnace, and it is made, by preference, of an oval form and corrugated vertically on its inner surface. A slight taper towards the top is also given to the retort, in order that it may the better discharge the coke when the illuminating gases are distilled therefrom. The retort is closed at top with a cast iron cover, which is formed with a valve seat for receiving a drop valve or plug, and projecting from the side of the cover is a pipe leading to the hydraulic main. The drop valve is used for covering the opening by which access is gained to the interior of the retort for supplying coal thereto, which may be discharged into the retort (until it is nearly full) from waggons run upon a level with the top of the furnace. The lower end of the retort inclines downwards, and extends to the outside of the furnace. It is closed by a door like the ordinary horizontal retorts, and similar means to that ordinarily adopted are used for securing the door in position, and making it air-tight. A small crane mounted in front of the furnace serves to facilitate the operation of applying and removing the door; the heat from the fire place is caused to circulate by means of a spiral flue *E* around the retort and heat it equably. The gases of combustion make their exit near the top part of the retort into the main flue, and thence to the chimney; *e e e* are sight holes, made in the walls of the furnace to enable the attendant to observe the degree of heat of the retort, and to give access to the flue for the purpose of cleaning out the same. The discharge of the coke when the coal has been carbonized is effected at the outlet.

The operation of the apparatus is as follows:—A quantity of coke is put into the retort (it having first been got up to the proper heat), sufficient to fill the bottom up to a level with the commencement of the vertical sides. Upon this bed of coke a charge of coal is discharged from a waggon running on rails fixed over or on a level with the top of the furnace or oven, or by any other quick and easy method, the drop valve being first raised from its seat. When the retort is charged the valve is lowered into its seat, and the heat of the furnace being kept up the gas will be quickly caused to distil off, and escape by means of the exit pipe to the hydraulic main (which may be fixed in any convenient position), and from thence to the condensers. When the coal is sufficiently carbonized the door is withdrawn from the retort, and swung aside by means of the small crane. The coke is then allowed to run out of the retort by its own specific gravity, either on to the ground or into waggons placed ready to receive it; a quantity sufficient to fill the sloping part or bottom of the retort being, however, retained therein by replacing the lid, which is then screwed in place and luted as before. The retort is then ready to receive another charge of coal. Should it be thought desirable, before this part of the process is performed, steam from a steam boiler may be admitted into the retort near the bottom. While passing through the red-hot coke it will be decomposed, and form gases valuable for mixing with the gas previously distilled from the coal. This decomposition of steam in the retort will have a two-fold effect; first, it will afford an additional quantity of gas at a cheap rate; and, secondly, when using coals which swell on being carbonized, the steam by decomposing or destroying part of the coke will facilitate its subsequent discharge from the retort. In addition to using steam, any of the hydrocarbon oils, tar, or such like substances may be economically converted into gas by injecting them into the bottom part of the retort by any well-known means. This part of the process may be carried on as long as may be considered desirable; but as the principal object in view is to make gas from coal it must only be continued so long as experience may prove it to be profitable so to do; the design of this supplementary distillatory process being to utilise the heat of the red-hot coke before discharging it from the retort, and which heat has been obtained in the first instance in converting the coal into gas by means of the fuel used in the furnace.

AMERICAN COURT AT THE INTERNATIONAL EXHIBITION.

I.

THE display of American products at the Great Exhibition would no doubt have been greater, but for the present unhappy conflict in that country. As it is, the American Court is well worth a visit, and deserves a careful study. Scientific men will recognise in the varied and useful inventions which are there exhibited, simplicity of construction and beauty of workmanship; and the unscientific will see much to admire in the appliances by which labour is made easy and toil pleasant. American "notions" are intensely utilitarian. Increased production at the smallest expense of labour is their maxim. Many of the machines here exhibited are adapted to field and farm labour, and it is no disparagement of our eminent agricultural engineers to say, that, in regard to these implements, the Americans have been able to hold their own, and maintain their position against all competitors.

On entering the court, which is at the south-east corner of the building, Wood's mowing and reaping machines occupy a prominent position. These are exhibited by Mr. Cranston, of King William-street, and have attained a large sale in England as well as in America. During the last eight years, 30,000 of them have been manufactured, 2,500 of which have been sold in England.

Fig. 1. (next page) represents the combined machine for either reaping or mowing. It is at present set up as a reaper, but can be easily changed to a mower by removing the reel and platform. A self-acting rake can be adjusted to the reaper, which will deliver the cut grain in bundles at the side. The rake is worked by a pitched chain which margins the platform, and carries the teethed end of the rake round with a smooth and uniform motion, the back end being supported by a double jointed guide. In its action it is very simple, there is no loss of power, and no risk of bruising the straw or shedding the grain. The driver, by the pressure of his foot on a spring, can stop or accelerate its motion, so that, however uneven the crop may be, the bundles deposited by the rake can be of uniform size.

Fig. 2 is the mowing machine which gained the first prize at the Royal Agricultural Society's show at Leeds, last year. Apart from the ingenious construction of this machine, it really merits inspection for the beautiful style and finish of its workmanship. Notwithstanding the sneers of some finical and fastidious critics about this Exhibition being a huge puff, and a vast advertising mart, we rather take it to be a school where all may learn much from each other. Our artizans and mechanics will get many a useful hint by comparing the workmanship of the various articles exhibited, and may emulate the excellence displayed by others without anything derogatory to themselves.

The mowing machine runs upon two driving wheels, which give motion to the cutters by means of simple ratchets in their pinions. Each wheel will act singly or together, so that if either or both be drawn forward, motion is given to the vibratory scythe. There is an arrangement, too, by which the motion of the scythe or cutters is instantly stopped when it is desired, or on the machine being backed, which it can be as easily as any ordinary vehicle. The cutter is placed in front of the driver, so that he can overlook his work, conform to the nature of the ground whatever its outline may be, raise or depress the cutter by means of a lever, and thus evade or slide over any obstructions.

These, and other kindred machines, are producing a wondrous change on the slow, rude forms of agricultural labour. The application of science to farming is making the land more productive, and it must be a great boon to the husbandman to be able to cut down his crops of corn or grass at the rate of twelve acres a day, over ridge or furrow, and on steep hill sides, and cut them closer and better than by the scythe.

While on the subject of husbandry, let the visitor walk straight across from these machines, and inspect some hay and manure forks manufactured by Batcheller and Sons, and exhibited by Messrs. Smith, of Doncaster. These forks look more like elegant toys than implements for laborious work. They are made of the best American cast-steel, with two, three, and four oval prongs, and are remarkable for lightness, strength, and elasticity. They are about half the weight of an ordinary English fork, maintain their perfect shape till worn out, and enable the labourer to do his work with ease and rapidity. They are the most perfect agricultural instruments we ever saw.

In a case adjoining these are exhibited coopers' axes, chopping axes, and adzes, from the Douglas Axe Company, Massachusets. These tools are of beautiful shape and finish; the steel is of the finest temper, and as specimens of American cutlery will, we think, be unsurpassed by anything of the kind in the Exhibition.

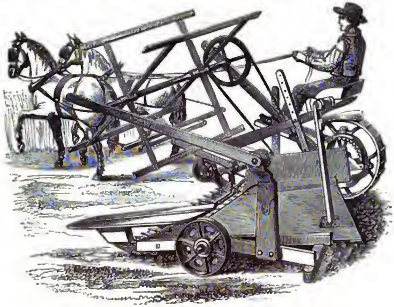


FIG. 1.—COMBINED REAPING AND MOWING MACHINE.

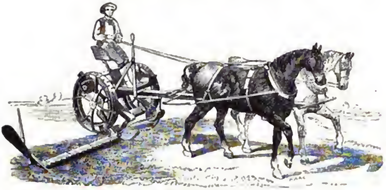


FIG. 2.—MOWING MACHINE.

The above is an illustration of Drake's Boring and Spacing Machine, exhibited by Mr. Wemple, Albany, N. Y. This is a novel and very useful invention for boring blind stiles, or any other wood-work where a series of holes are required at equal distances apart, doing the work with great accuracy, and saving the labour of spacing and laying it out. The bits *c c*, twenty in number, are driven by one continuous belt *i*, instead of separate belts, as in some other machines. The distance between the holes may be varied by simply moving the lever *d* by the handle *g*, when the transverse rods *b b* regulate the distance of the bits. The wood to be bored is placed on the movable table *a a*, which is brought forward and pressed against the revolving bits. The machine, though having the appearance of being complicated, is really very simple and effective, doing its work, which otherwise would be tedious, with great rapidity and precision.

On passing Ward's Ocean Marine Telegraph, which we noticed in a recent number, we found him in the midst of a circle of enquiring visitors, who were taking a lively interest in his invention. On a table before him he exhibits two models which are worthy of notice. One is an improved wheel for railway carriages. The tread of this wheel is in form of an O G moulding, which runs with great smoothness, prevents the flange from grating against the rail, and renders it less liable to jump off. The other is a simple substitute for the ordinary castor for table legs and bed posts. It consists of a ball set in a neat brass moulding, which runs upon smaller balls at the top, and by vertical pressure moves easily in any direction without the necessity of a joint or the liability to injure the carpet. It is one of those simple contrivances which commends itself to one's approval at first sight, and appears to be on the same principle as a turntable exhibited by the same inventor in the Eastern Annex, which we have noticed in another column.

Beardsley, of Otsego County, New York, exhibits two machines of a very American-like appearance, which have attracted considerable attention in that country. The hay elevator is intended for unloading hay into the barn, or on to the stack. Fig. 1 represents the fork or lift, the points of which are 3 feet apart when open. The two arms move on a pivot, and are made to clutch the hay by tightening the chain. A trip-

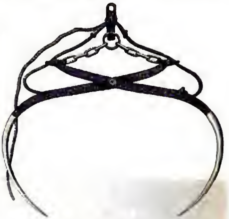
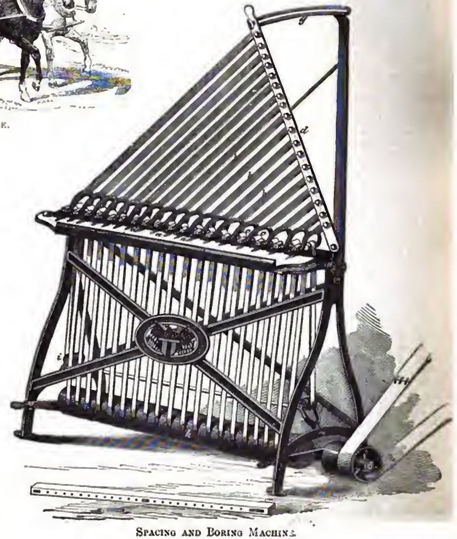
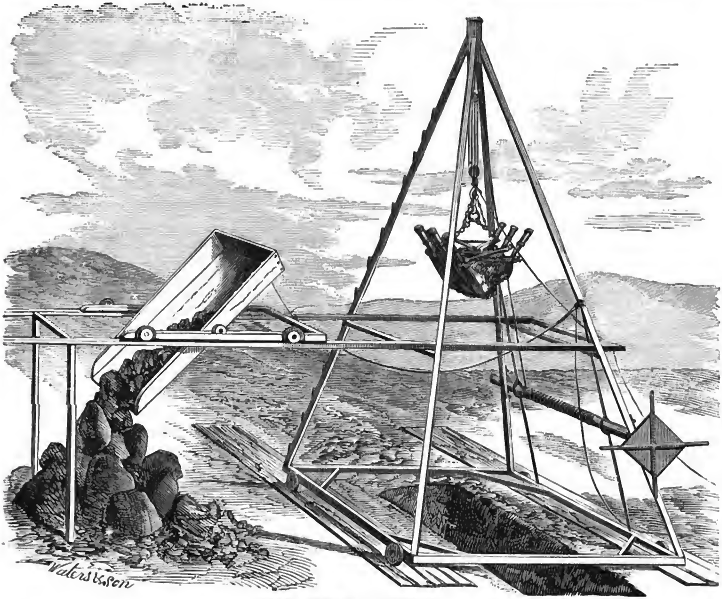


FIG. 1.—HAY ELEVATOR.



SPACING AND BORING MACHINE.



Earth Elevator in Operation.

hook, Fig. 2, is put into the ring of the chain, or to unload by horse-power, a sheaved block, Fig. 3, is attached to the ridge, and another on to the floor where the horses are hitched, and as they walk off on to the ground, up goes the fork with one-third of a waggon-load at once. The trip-hook is let loose by jerking a catch-cord, and down goes the hay. By this means a ton of hay may be unloaded by five lifts of the fork. Some contrast, this, between pitching a fork full at a time, under a scorching July sun.

Fig. 2.

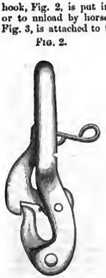
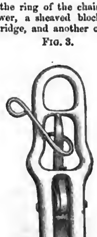
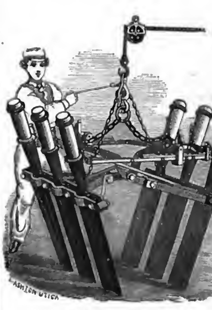


Fig. 3.



The earth elevator, by the same inventor, is on a similar principle. It is meant chiefly for drain cutting and ditching, and has the same object in view, rapid working, and the saving of hard labour. By the engraving it will be seen that the elevator has six spades, three on each side. The spades are made of boiler iron, and have a strong socket handle rivetted firmly to the blade. They are driven into the soil one by one, at an angle through a strong iron frame. These frames have each an arm that pass by each other, and are secured together by a bolt and nut. A strong chain passes from the end of one arm to the other. This chain has a centre ring, in which the trip-hook—same as in the hay elevator—is hooked when the elevator is ready to be drawn up. A small chain passes from each side of the trip-hook down to the elevator to open it. A brace extends from the spade handle to the next opposite handle, to keep the spades at the angle that they are driven in the earth. When the large centre chain is dropped a latch is pulled, and these braces are closed together, letting the spades assume a perpendicular position, and discharge their load.

The illustration above will shew the mode of



Earth Elevator.

operation. The elevator is hoisted in a gin, and may be worked by hand, horse, or steam power. This gin is made of four poles, twenty or more feet in length, secured in a frame at the base and meeting together at the top. Half-way up the poles are secured timbers for a railway, on which a dumpany car is made to move, to receive and carry off the earth raised in the elevator. The base of the gin is twelve feet square, having wheels to roll upon plank laid on the ground. The railway may be somewhat inclined, that the car may move by its own gravity. The extreme ends of the railway may move upon wheels, the wheels moving upon a single track underneath. For making embankment or draining on a large scale, we think the machine merits attention.

We shall return again to this Court, and would recommend those to visit it who are looking for the useful more than for the showy. There are some things here which will yet make themselves known in the old world as well as in the new.

JONES'S PATENT MARKING MACHINE.

In the Mechanics' Magazine of the 17th of May, 1861, we took occasion to refer, in complimentary terms, to a new mechanical contrivance for preparing the edges of discs of metal, intended for coin, or what is known among the initiated in money-making as a "marking machine." We were pleased, therefore, on paying a visit lately to the Royal Mint, Tower Hill, to find our impressions as to the usefulness and value of the invention completely realized. We were informed, indeed, that since the introduction of the patent marking machine to the coining department of the Mint, it has had transferred to it the whole of the work which formerly required the services of eight ordinary machines.

So universal is its application, and so rapid and exact is its action, that we were not surprised to learn that other mints were beginning to appreciate its usefulness, and to adopt it in place of the antiquated machines for the same purpose hitherto used. Two of the machines have just been finished and forwarded to India for the Madras Mint, and doubtless when its merits are properly known, it will become an integral part of every continental mint. It is unfortunate that one of the machines was not placed in the Western Annex of the International Exhibition, so that it might be inspected by the numerous foreign gentlemen interested in minting operations who are now in London—or who may be expected to come during the continuance of the magnificent display at South Kensington. Probably the inventor imagined, however, that the machine would be seen to greater advantage when actually engaged in the work of raising the protecting edges on gold or silver coins—a feat it performs at the Mint at the rate of about 700 per minute. There is no difficulty, we believe, in obtaining admission to the Mint—at least under the *regime* of its present courteous master, Professor Graham, F.R.S.; and those who are desirous of seeing the ingenious contrivance, and are interested in coining operations, may do well to make application to that gentleman.

Some idea may be formed of the simplicity and durability of the patent marking machine of Mr. Jones—who, by the way, is a mint employé—when it is further stated that one machine has operated upon the whole of the coinage, gold, silver, and bronze, which has been struck at the Royal Mint during the last sixteen months, and this without renewals or additions of any kind. Messrs. Watt and Company, of Soho, near Birmingham, who are the contractors for upwards of 1,700 tons of the new bronze money, now so largely and satisfactorily in circulation among her Majesty's subjects, adopted the new marking machine many months since, and report highly, it is said, of its merits.

It appears to us that there are other branches of manufacture besides coining, to which the principle, at least, of the marking machine may be applied. Wherever it is necessary to administer pressure evenly and forcibly to the circumferences of circular pieces of metal of any kind, for instance, as in some kinds of button making, it would be applicable. No doubt the marvellous ingenuity of some of our Birmingham friends would quickly suggest other and profitable uses for the marking machine. At any rate we shall make no apologies for offering the suggestion, which indeed we do with the knowledge and approval of Mr. Joseph Newton, the chief of the mechanical department of the Royal Mint, who himself devised a double-acting air pump, for coinage purposes, and which has saved many hundreds of pounds to the State. An advertisement, in another column, conveys further information as to the Patent Marking Machine.

A NEW PLAN FOR UTILIZING SMALL VESSELS.

Captain Selwyn, whose name will be familiar to our readers in connection with a system of laying submarine telegraphic cables, which we are glad to see is attracting fresh notice from the scientific journals, has proposed that experiments should be tried with a view of utilizing the smaller vessels of our existing navy, and enabling them to carry defensive armour. His idea seems to be that, following the principle of the double canoe, two gun vessels may be joined firmly together side by side. That in this condition only so much armour will be required to protect the two as would otherwise have been necessary for the defence of one. That the value of two screws, two keels, and two rudders, will by this method be fairly tried; and that by the use of longitudinal compartments the danger from rams may be avoided or lessened. The ram for the double vessels may be introduced between the two bows in a favourable position for strength; at least it would appear that the idea is worth a trial, in the present state of uncertainty, as to what can be done with the wooden vessels (particularly the smaller classes), of which our navy is now composed.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41 Corporation-street, Manchester, on Tuesday, May 27th, 1862, Thomas Schofield, Esq., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the last month there have been examined 316 engines and 464 boilers. Of the latter, 9 have been examined specially, 10 internally, 74 thoroughly, and 371 externally; in which the following defects have been found:—Fracture, 6 (3 dangerous); corrosion, 50 (7 dangerous); safety-valves out of order, 6; water gauges ditto, 15; pressure gauges ditto, 5; feed apparatus, 1 (dangerous); blow-off cocks ditto, 34 (2 dangerous); fusible plugs ditto, 6; furnaces out of shape, 6; Total, 129 (13 dangerous). Boilers without glass water gauges, 29; without pressure gauges, 10; without blow-off cocks, 34; without back pressure valves, 33.

"Explosions continue to occur to every description of boiler. One has happened during the last month to a locomotive in the vicinity of London, and another to a stationary boiler on the Clyde. Both of these were—as it is hardly necessary to state—beyond the sphere of the operations of this association. Each of these explosions was attended with fatal consequences, but I am not at present in possession of the engineering fact.

"The recent very frequent occurrence of explosions has monopolised, by the bare recital of their details, the entire space of the late reports, and left no room for considerations resulting from them, to which I think it is important attention should be drawn, and which, therefore, I now purpose to do.

"It will be remembered that one of the late explosions arose from the failure of an angle iron, on which alone—as on a single thread—a large crown plate depended for its support. Several other explosions occurred to externally-fired boilers through failure of the plates just at the seams of rivets exposed to the flame. In some of such cases, the plate is found to crack at the rivet holes; in others, leakage occurs, from which corrosive action sets in, and steadily continues until the plates become so thinned that rupture and explosion ensue. Some explosions have occurred from corrosion consequent upon external damp; others, from acidity of the water; while others, again, of somewhat earlier date, have been occasioned by the collapse of the furnace tubes, consequent upon weakness of construction, which would have been remedied by the adoption either of flanged seams, T or angle-iron hoops, or other similar means.

"Thus it will be seen that all the above explosions occurred from the most simple causes, and that no mystery whatever need be attached to any one of them; while, by suitable construction of the boilers, in the first place, and due attention to their state of repair, in the second, these explosions would in every case have been prevented.

"I am extremely desirous to keep this practical view of steam boiler explosions constantly in sight, since I am persuaded no head will be made against them generally, as long as their causes are considered to be matters of mystery, and their occurrence one of chance.

"Very few of the explosions that come under my notice occur from shortness of water; and I believe that to be a much abused idea, and the number of explosions resulting from it to be much exaggerated. It appears to be an almost stereotyped verdict at inquests, and the boiler attendant being frequently killed, there is seldom any witness to the contrary.

"I find that by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction, or state of repair consequent upon use; while those explosions resulting either from deficiency of water, or from extraordinary or reckless pressure, are comparatively rare. In other words, to prevent misapprehension, I find that explosion is more frequently due to weakness of the boiler than to excessive pressure of the steam.

"I know no means of ascertaining the sufficiency of the original construction of a boiler, or of detecting the weakening effect produced upon it by wear and tear—in short, of testing either new or old boilers—equal to the use of hydraulic pressure, and think all steam users would do well to make systematic use of this test once a year. In France, I believe, this plan is rendered compulsory by the Government, and it would be well were it generally adopted in this country voluntarily. Weak places in the plates may pass undetected, even on careful examination, while some parts may be inaccessible and concealed from view, but the hydraulic test is sure to detect and expose them all. Its timely application would have saved that most disastrous explosion which occurred some time since, here in Manchester, at a locomotive establishment second to none in the kingdom for its high reputation, and since a defect passed unnoticed at such an establishment, where the construction of boilers, as well as the quality and strength of plates, may well be supposed to have been thoroughly understood, it surely argues the necessity of the hydraulic test being generally applied.

"Mr. Muntz, a steam user in Birmingham, states in a letter published on the Millfield boiler explosion, that he has for years adopted, with advantage, the plan of an annual hydraulic boiler test, and considers it a duty he owes to his workmen in consideration of their safety.

"The application of the hydraulic test is so simple, and the pump required so small, that each steam user could provide himself with one at very little expense, or some parties might find it worth their while to take up the proving of boilers by water pressure as an itinerant speciality of engineering practice. This Association would be glad to assist in the general application of the hydraulic test, by inspecting the boilers when under pressure; and I feel convinced that, were the practice of this annual test generally adopted, which I trust it soon will be, explosions would become nearly, if not entirely, extinct."

Cohesive Strength of Metals, &c.—Cast iron, 42,000 pounds; iron bar (best Swedish and Russian), 81,000 pounds; ordinary 68,000 pounds. Steel bar, soft, 120,000; razor tempered steel 150,000 pounds. In steel, and *willow* wood, the *cohesive and repulsive* strength appear to be nearly equal. Oak will suspend much more than fir; but fir will support twice as much as oak, probably on account of the curvature of the fibres of oak. Although iron, at an average, is four times as strong as oak, and 5½ times as strong as deal or fir, yet it is more liable to accidental imperfections; and when it fails it gives no warning of its approaching fracture. Wood, when it is crippled, complains, or emits a sound, and after this, although it is much weakened, it may still retain strength to be of service.—J. B.

TO CORRESPONDENTS.

Received.—J. B., S. T., J. M. C., A. S. C., J. A. D. (let the matter drop), J. C. and Co., E. J. R., H. J. J., E. T. H. and Co., Isle of Man, R. T., W. H. P., P. D., Mack., W. B. D., R. T. S., J. N., J. H. E., E. P.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

SYSTEMS OF SHIPBUILDING.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I beg you to have the kindness to insert the following suggestions in your widely circulated paper on building ships of war.

These propositions were published by Mr. James H. Milberg, the 20th of May, at Munich.

Reflection system, tun system, mixed system, which systems will in future, according to his views, predominate wherever iron is used in defensive purposes, both on land and water, for coast batteries, fortresses, and fortified camps. The laws of nature must be the basis for the plan of every construction.

The reflection system is founded on the law that a ball will always reflect in the angle of the incidence, at least will do so if it does not enter the resisting object; as illustrated in the game of billiards.

The tun system is founded on the law of the arch or wheel, dolioloide system, according to which it is proved impossible for the wider part of the curve to crush into the smaller, so that the whole arch combines to resist any pressure or blow from without. That produces its immense defensive power Starting from these two laws known by every one, Mr. Milberg would build ships, batteries, fortresses, encampments, as well as field defences, 'according to them, when the works can possibly be built of iron or other metal.

He proves if we allow ourselves to be instructed by one of these laws in erecting iron defences, the first condition will be, that we abandon all perpendicular surfaces, which offer to the enemy the means of employing their whole offensive power against them. To deprive the enemy in great part of this advantage, we must construct a vessel the exterior of which shall present an angle in every part subject to the attack of the enemy, so that balls may be reflected up or downward according as they strike the lower or the upper portion of the angle forming her sides.

If we adopt another law (that of dolioloide) we shall have a ship cylindrical in form, her head and stern perfect hemispheres.

This reflecting system is shot-proof, because it must cast back again the ball directed against it, and ships by it have the advantage that they can be built light, and will not be less rapid than those built of wood.

The cylindrical system is shot-proof, being founded on the law of the arch; it has the advantage that it enables the vessel so constructed to have any given size, though it would be much heavier than in the reflecting system.'

The third system is founded on both the former, which can be united as size, speed, or tonnage, is required.

These discoveries, founded on natural principles, by right application, will soon revolutionize our present practice of firing at flat plates, and will introduce a new character into our military and naval experiments and plans.

W. R.

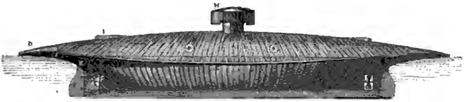
Munich, May 21, 1862.

◆

ARMOUR-PLATED STEAM RAM.

Sir,—I enclose a rough sketch of an armour-plated steam ram, of 1,000 tons, which I think combines in itself all the requirements of the present altered condition of naval warfare, suitable for the defence of rivers, harbours, and sheltered places along the sea coast. It is designed on the principle of securing great resistance to shot, and yet, by a certain amount of yielding to each blow, paralyzing its effect, and rendering great thickness of armour unnecessary. Its form, being without angles or flat surface, is also a vast protection, as shot striking anywhere would glance off. The peculiar shape of the funnel is to prevent live shells being dropped down into the furnace beneath; and the beaks being level with the water-line of any ship they struck, would, whilst effectually disabling an enemy, give the crew plenty of time to escape to their boats ere the shattered ship settled down. There is something too utterly diabolical in driving in the side of an enemy's ship, and sending her and all the crew to the bottom, if the same end can be accomplished without a sacrifice of human life.

ARMOUR-PLATED STEAM RAM.



The yielding action I propose to obtain by covering the inner skin of the ram by vulcanised Indian rubber, six inches thick, and placing the armour plates thereon, fastening them with strong wire rope, instead of the present defective mode of nuts and bolts.

The armament might consist of six 300-pounder Armstrong guns, those pointing at the sides to have their muzzles fitted to their respective ports, so as to leave no openings for opposing musketry. The only entrances to the vessel being through the ports of the bow and stern chasers, boarding would be impossible.

The double screw would be of the utmost value in rapidly backing the ram to repeat a blow, when necessary. Ventilation might be amply secured by fanners driven by the engine.

C, strong malleable iron rib, running round and terminating in the beaks *D D*; *E E*, heavy iron keel, stem, and stern-posts, all in one piece; *F F*, rudders—the one fixed while the other is being used; *H*, funnel, contrived so that a shell could not be dropped down; *I I I I*, guns of the largest calibre—six in all; *J*, openings, three inches wide, for observation and air.

I remain, yours respectfully,

William Cochran.

43 Virginia-buildings, Glasgow, 23rd April, 1862.

◆

ATLANTIC TELEGRAPHS.

Sir,—Judging from the weakness of "Short Circuit's" rejoinder to my letter of the 16th, he must be the identical barrister whose brief is said to have contained the following instructions—"There is no case. Abuse the opposite attorney." He has altogether abandoned the question started in his first letter. However, unless he removes his mask, and signs his name to his correspondence as I do, he is quite at liberty to smear your columns with hebdomadal abuse as long as you see fit to allow him that privilege, steering clear, however, as he must do, of the law of libel, towards which he has made some pretty close sailing in his last production. When he openly declares himself and his disciples, as I have challenged him to do, we shall see whether or no his name and antecedents are such as to inspire confidence, and whether my own thirteen years' probation in telegraphic matters does not entitle me to a belief, equal in weight to his own, upon a question which is simply founded on a judgment of certain facts open to all.

Meanwhile, I address this final communication to you, in order to set right one or two matters (extraneous to the main subject) into which your correspondent has wandered.

First.—A message from our vice-chairman to Mr. Field is quoted, and a base insinuation is put forward respecting it, which no man who had the pluck to sign his name to his letter would have dared to throw out. I can most truthfully say that neither any of the board nor myself had, at the time when that message was sent, the slightest idea that anything was wrong with the cable, and that it was on the faith of the representations of their scientific officer that a committee of the board went to Valentia to take measures, not about battery power, or any scientific question, but for the proper protection of the public in the transmission of their expected messages.

Second.—"Short Circuit," "*et id genus omne*" (if he will persist in quoting Latin), must be ignorant of the first principles of electrical force, in quoting from the certified report of messages sent through the cable, in order to support his statement that great battery power is needful for long circuits. In the extract he has selected it is shown that it was only after they had put on 100 Daniell's batteries that they got "splendid signalling." He ought to have been aware that the *tension* of 100 cells of Daniell's is insignificant compared with that of the enormous coil currents that had previously been sent through the cable, and that it is by "tension" far more than quantity that small faults are made large ones.

If he had ingeniously studied the subject, however, he would have found that there was a subsequent time when coils and batteries were allowed to discharge their united force into the cable, not by "inexperienced" directors and secretaries, but by some of the "great guns" of science, and that the result of that operation was—eternal silence!

Third.—"Short Circuit" quotes Sir Charles Bright and others on the subject of the law of squares; but I defy him to elicit from either of those gentlemen a statement in writing to the effect that the law of squares is not as stated in my letter of the 16th, "subject to enormous modification by surrounding circumstances;" and I say that Mr. Latimer Clark, the partner of Sir Charles Bright, and the gentleman who conducted the elaborate experiments upon this and other scientific points for the Board of Trade, states in his most able report appended to the Blue Book on Submarine Telegraphs, that his experiments showed the law of retardation to be, not as the square, but in simple proportion to the length of line.

Fourth.—"Short Circuit" says that I "do not tell quite the same story at different times about the lengths on the northern route;" but there I "have him on the hip." In 1860 a paper was read at the Geographical Society, in which it was stated that the promoters of that route intended to land on the *east coast* of Greenland and carry a *land line* across that *verdant* country! and maps were handed about showing, paper fashion, the way to do it; but this *canard* proved too tough for the digestive organs even of the humblest among the few adherents of the scheme, so it was determined to say that the line should be carried *round Cape Farewell* (which is often belted to a distance of 100 miles with impassable ice), and that it should be landed at that paradise of seals, icebergs, and Esquimaux, yclept Julianashoab, the "capital" of the Artic archipelago. In this way the distance measured in cable to be expended between Iceland and West Greenland is under stated by me at the increased total of 920 miles.

Finally.—I say that Sir Leopold McClintock in his *report to the Admiralty* which accompanied his soundings, uses the following words as to Hamilton's inlet and his actual experience of it:—"*We found the depths to be very irregular, and seldom sufficient to secure a cable at the bottom from icebergs. It may perhaps be true that the large icebergs seen off the mouth of the inlet are at all times kept out by the flow of water, so as never to ground, but with my present knowledge of its depths I would not recommend a cable to be brought there;*" and further, that even in his letter to Sir Charles Bright, which is carefully pruned of such naughty passages as the above, Sir Leopold does not state his opinion in favour of the northern route *as compared* with any *other route*, but merely says that in his opinion the northern route is practicable,—a view diametrically opposed to the opinion of the eminent Dr. Wallich, who specially accompanied the expedition as its naturalist, and whose report, if he were ever asked to make any, has never yet been published.

I have now done with "Short Circuit," and shall not reply to any more of his lucubrations under that signature or any other pseudonym.

Yours truly, G. Saward.

1 Pembury Place, Camberwell Grove, Surrey.
May 27th, 1862.

◆

CUPOLAS AND FORTIFICATIONS *v.* MACINTOSH'S SYSTEM OF WARFARE.

Sir,—In the *Times* column of "Naval and Military Intelligence," of the 26th instant, it is stated that "the conversion of the Royal Sovereign to a shield-ship on Captain Coles's principle is progressing with great rapidity," but it is considered that "the down draught through the shield and towers will carry down the gases evolved by the burning of the powder when firing the guns, and probably extinguish the fires in the furnaces," and it is asserted by officers who were present in the attack of the allied fleets upon the sea defences of Sebastopol, that a similar difficulty was fully realised on that occasion, even with ships having a far better system of ventilation than the Royal Sovereign can have as at present arranged. May I ask if the smoke of gunpowder causes such inconvenience, what would be the position of such vessels if attacked by swift shot-proof steam vessels on Macintosh's system of warfare, discharging inflammable liquid with precision, which ignites spontaneously, rushing into the crevices, destroying everything combustible, and rendering the air pernicious to life? In a like manner could the strongest sea face fortifications be rendered untenable.

Your obedient servant,

USEFUL EFFECT.

May 28th, 1862.

TO PREVENT MUCH MISCHIEF TO SEA EMBANKMENTS, OR THOSE OF RIVERS.

SIR,—I recommend in those cases where a breach is actually made therein, to prevent it from increasing in width, the timely application of old sails fastened to each side of the breach, where the water enters, which will allow the water to slide over them, and hinder more of the earth from being carried away.

One word of advice, in conclusion, which is to sow the seeds of the *Sand Reed*, which do not require any manure, will grow on barren sands without the care of the husbandman, and which furnish an abundance of flour. *These furnish insurmountable barriers to floods and storms!* I am, Sir, yours, &c.,

JAMES BRUCE.

Gossip.

THE statement in our last number that Mr. Laird was appointed a member of the Iron Plate Committee was founded on the communication to that effect made by Lord Clarence Paget to the House of Commons, as reported in the daily papers. This communication was so precise, that it left no room for doubt, as in reply to an observation of Mr. Laird, who said he knew nothing of the appointment, the Secretary said, "I signed the letter to you yesterday." It appears there has been some misunderstanding on this subject. Mr. Laird is appointed a member, not of the Iron Plate Committee, but of a Special Committee for the examination of plans for covering iron ships with copper sheathing—a question which occupies the earnest attention of the Admiralty, as inseparable from a perfect system of construction of iron men-of-war.

On Monday last a splendidly decorated fire-engine was presented to Mr. Frederick Hodges, at his distillery, Lambeth, as a testimonial for the public services which that gentleman had rendered in saving life and property from fire in various parts of London. Mr. Hodges made a suitable reply. A large number of gentlemen from various parts of the Metropolis were present, including several well-known Americans. After the ceremony, and a trial of the fire-engine, about eighty gentlemen partook of Mr. Hodges' luxurious hospitality.

On Tuesday evening last the annual *soiree* of the Institution of Civil Engineers was held at Great George-street, Westminster. A large number of gentlemen, introduced by Mr. Hawkshaw, the President of the Society, were present, including many distinguished foreigners. The rooms of the Institution were so inconveniently crammed, that we had little or no opportunity to examine the various models, diagrams, that were on the tables, and that adorned the walls.

The Atlantic Telegraph Company appears at length to be commencing active operations. The Government have granted the use of ships, officers, and crews to make new and additional soundings on the line between Ireland and Newfoundland. This line has already been twice sounded, namely, once by American officers, and secondly by Commander Dayman, R.N. The desirability of perfect survey for submarine telegraphic purposes is now, however, so fully recognised that it has been determined on some portions of the line to take soundings every mile. The landing places also will be surveyed with great care, and every means taken to obtain a thorough knowledge of the irregularities of the bottom along which the cable is to be laid. One of Her Majesty's ships has already commenced fitting for this service on the Irish side, another will shortly be ready to take the same at Newfoundland. The Government have also consented to appropriate such ships as may be necessary to the service of assisting in the submersion of the cable between Ireland and Newfoundland. Their services will consist in sounding and rendering every assistance to the vessels in the actual operation of paying out cable. These latter vessels will, in future, have to be specially constructed so as to give the greatest possible facility to the paying-out arrangements, and to provide for the retention of the cable under water during the whole time it is on board from the period when it leaves the manufacturer's premises. It is obvious that ships-of-war could not, therefore, be adapted to perform these duties in the best possible manner, and, indeed, the time is fast coming when ships will have to be built specially for the service of laying cables; by which means, in addition to the other improvements suggested by experience, and now universally acknowledged, these works will be rendered as certain of a successful result as any other engineering business.

It will have been observed, probably, that on the motion of Sir. Hugh Cairns, the House of Commons, on Tuesday last, agreed to an address, praying for a Royal Commission to enquire into the present working of the laws relating to patents. We are glad that this important subject has been taken in hand, and sincerely trust that the commissioners, whoever they may be, will deal with the question in a liberal, enlightened, and fearless spirit. There are many anomalies and inconsistencies in the existing laws relating to patents of invention, and the time has certainly arrived when they should be swept away. On several occasions we have pointed out the evils which disfigure the law as it now stands, and suggested alterations which ought to be made, and which we are convinced would work advantageously both for the public and inventors. In an article published in the MECHANIC'S MAGAZINE of the 18th of April last, especially, the question was entered into with some degree of minuteness, and our own views thereon were freely expressed. It is satisfactory to find that so able and intelligent a statesman as Lord Stanley, who we trust will be nominated as a member of the coming commission, agrees almost completely with the statements to which expression was given in our pages, on the occasion referred to. We shall not fail to urge at all seasonable opportunities the claims of inventors to consideration and careful enquiry. There is no doubt whatever as to the policy or the justice of having a patent system of some kind, for the protection of those who devote time, skill, and money, to the perfecting of schemes and plans, having for their object the advancement of the public interests. We say this fearlessly and earnestly, notwithstanding the teachings of certain men of eminence in the mechanical world, and whose opinions generally we may respect. Fortunately the matter of policy will be only incidentally, if at all, entertained by the Royal Commission, whose main task will be one of reformation rather than of subversion. In that task we trust that the members will be assisted by all who are capable of rendering them assistance, and in that case it will be but fair to expect that their labours will result in paving the way for beneficial legislation. The modification of the patent laws, effected by Parliament in 1852, was in all ways satisfactory as compared with the previous state of affairs, and we are not without confidence that 1862 will give birth to improvements as substantial as the amendment Act of that period effected.

In the Western Australian Court a curious cabinet is displayed, constructed by the convicts at the depot at Freemantle, of every wood which the colony produces, comprising sandal, jarrah, tooarh, raspberry jam, the oak, and a score of other woods; the scent of the sandal wood which lines the drawers is very fragrant and agreeable. The cabinet stands upon a pedestal or solid block cut from an excrescence of the jarrah tree, twenty feet from the ground, of which there are several other specimens in the court.

The report of the Commissioners on National Defences, on the question referred to them as to circumstances whether the action between the Merrimac and the Monitor in Hampton Roads, were not such as to modify their opinions respecting the adaptability of forts for the defence of Spithead, was issued this morning. The report goes over a variety of considerations on the question, which, say the commissioners, "lead us to the conclusion that fortification is a necessary element in any arrangement for our permanent security, and that the construction of forts at Spithead is essential for the protection of that anchorage. In proportion to the development of the power of artillery, the value of the forts will be increased, and the space to be defended by floating batteries diminished. But whatever that space may be, the support of forts is necessary to give the defence a superiority over the attack. We therefore adhere to the opinion expressed in our report of 26th February, 1861, appended hereto, that the combined system of forts and floating batteries therein recommended will be not only the most economical, but the only really efficient mode of providing for the defence of Spithead."

A RIVAL OF GAS.—An American paper says:—"It is said a plan is about to be brought into use in the East by which petroleum can be converted into first-rate illuminating gas at a cost of about fifty cents per thousand. If the statement is correct we will soon witness a revolution in the business of illumination that will place a most effectual check on gas monopolies. No other corporations, chartered for any purposes whatever, not even mammoth railroad companies, enjoy the same independent monopoly as gas companies. An association which puts up a so-called 'gas-measure' in your cellar, keeps its own accounts of the register, admitting no error or contradiction, and shuts off your supply gas at its own will and pleasure, is not likely to become popular, even with green old age, and the evil is none the more endurable because there is no remedy. Thousands, then, will rejoice in the success of the petroleum gas."

SUBSTITUTE FOR COTTON.—*The Conserva Plant.*—It is met with in every ditch and pool, especially in old clay pits, and in most slow streams. It is of a soft substance, and in pure water, where the threads grow long, resembling tow. But in muddy waters, where they are short, it is not unlike cotton; which being carefully collected and dried, turns whitish, and has sometimes being used for it, either as wadding, or to make towels and napkins, for stuffing beds, and for making paper. In every country there is a great annual waste of cotton used in wicks for candles and lamps, and, in order to economise cotton for the future, I strongly commend this plant, as a substitute, to the parties most interested.—J. B.

A PHENOMENON.—In boring for oil in a deep gulch just above New-Cumberland, Hancock county, Va., a short time since, at the depth of some hundred feet the workmen suddenly struck a reservoir of gas, causing the water to spout out of the orifice to the height of forty feet or more. The stream, some three inches in diameter, appears to be intermittent at intervals of about two minutes, and the gas makes its appearance in the water of the run for a considerable distance around. The water is clear, cool, and fresh, and spouting has all the appearance of a natural fountain of most beautiful proportions. There are also indications of oil. The spectacle is a great curiosity in that region and attracts crowds of admirers.

MEETINGS FOR THE WEEK.

MON.—*Soc. of Engineers*, Discussion on Mr. F. Young's Paper "On the Use of Coal in Furnaces without Smoke," at 7 p.m.
British Architects, "On an Æsthetic Principle in Decoration," by J. W. Papworth, Esq., at 8 p.m.
Geologists' Association, I. "On Mine Surveying and Planning, and the Instruments Employed Therein," by W. T. Scott, Esq., F.G.S. II. "On the Older Parian Formation at Pointe a Pine, Trinidad," at 7 p.m.

TUES.—*South Kensington Museum*, "On the Formation of a National Museum of Architecture, as viewed especially in connection with the Mediæval Styles," by G. G. Scott, Esq., R.A., at 8 p.m.
Royal Inst., "On the Art of the Last Century," by Rev. Geo. Butler, M.A., at 3 p.m.

WED.—*Geological Soc.*, I. "On the Disputed Affinities of the Purbeck Mammalian Genus *Plagiaulax*," by Dr. H. Falconer. II. "On some Fossil Plants from Hempstead, Isle of Wight," by Professor O. Heer and W. Pengelly, Esq. III. "On some Surface-markings on the Sandstones near Liverpool," by G. H. Morton, Esq., at 8 p.m.

THUR.—*Royal Inst.*, "On the Chemical Arts," by Lyon Playfair, C.B., at 3 p.m.
Antiquaries, at 8.30 p.m.
Linnean, at 8 p.m.
Royal Soc., Election of Fellows.
Architectural Association, "On the Modern School of Painting in Germany, Holland, and Belgium," by Mr. H. Ottley, at 8 p.m.

FRI.—*Royal Inst.*, J. Tyndall, Esq., at 8 p.m.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c. *None.*

BOILERS AND THEIR FURNACES, &c., 2778, 2787, 2794.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2775, 2807, 2817, 2836, 2838.

SHIPS AND BOATS, including their fittings, 2780, 2788, 2834.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2802, 2816, 2818, 2854.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2798.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2775, 2777, 2779, 2791, 2792, 2793, 2799, 2803, 2808, 2809, 2812, 2826, 2833, 2837, 2842, 2846, 2847, 2848, 2849.

Digitized by Google

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c. 2835.
Lighting, Heating, and Ventilating, 2795, 2796, 2801, 2815, 2822, 2829, 2830, 2851.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2781, 2786, 2808, 2814, 2821, 2823, 2824, 2825, 2828, 2839, 2840, 2841, 2853, 2857, 2858, 2859.
Metals, including apparatus for their manufacture, 2782, 2784, 2810, 2845.
Chemistry and Photography, 2819, 2831, 2855, 2860.
Electrical Apparatus, 2850.
Warfare, 3, 2774, 2785, 2805, 2832, 2853, 2856.
Letter-Press Printing, &c. *None.*
Miscellaneous, 2776, 2783, 2789, 2790, 2797, 2800, 2804, 2811, 2818, 2820, 2820, 2827, 2843, 2844.

2773. J. Livesey. *Improvements in apparatus for communicating from one part of a railway train to another, and for coupling pipes.* Dated Nov. 5, 1861.

This consists of an apparatus for sounding whistles or other alarums, by which the guards and other persons may communicate with each other, and with the engine driver. A system of pipes extends from the engine to the various carriages and vans of the train, and at each guard's van, or other convenient carriage, a branch pipe connected to a bellows and a whistle is applied; the end of this pipe is in communication with a small cylinder, the piston of which is connected to a lever fixed to the top of the usual steam whistle on the engine. When the bellows are worked, the compressed air passes through the pipes and sounds the whistles. *Patent abandoned.*

2774. E. Brooks. *An improvement or improvements in the manufacture of bayonets.* Dated Nov. 5, 1861.

This consists in fashioning or shaping the blades of bayonets by dies worked by a stamp, whether the whole of the blade be operated upon at the same time by one pair of dies, or different parts of the blades be operated upon in succession by different pairs of dies. Fashioning or shaping the socket neck and shoulder of bayonets by a pair of dies worked by a stamp. *Patent completed.*

2775. W. Hall. *Improvements in the production of curved and other forms in articles of lace.* Dated Nov. 5, 1861.

Here the lace fabric desired to produce the required forms is woven in a straight line, as the most convenient for the purpose, though the patentee does not confine himself thereto, and there are angular or other spaces in the figures or ornamentation thereof, such that, when the part within such spaces are cut away and the other parts and the remaining edges sewn together, the required form will be obtained. *Patent completed.*

2776. C. F. Hayes. *Improvements in means or apparatus for generating steam.* Dated Nov. 5, 1861.

The object here is to obtain a very rapid generation of steam. For this purpose the patentee uses a metal pipe of small diameter, but of suitable strength, placed so as to be subject to the direct action of the heat of the furnace, as the means for holding and supporting the water during its conversion into steam. As steam is desired to be generated he causes water in very small quantities to pass into the heated part of the pipe, by which the water immediately becomes converted into steam, which by a valve or other passage passes into another pipe (or an extension of the piping) which is laid in coils or otherwise in a superheating chamber, and there this pipe terminates in a rose head or other suitable means adapted to finely distribute the steam obtained into this chamber for the ready conversion of it there into high pressure steam. He uses a small force pump worked by a steam engine or other power for the purpose of forcing the water from a suitable reservoir into the piping. The superheating or surcharging chamber is formed and fixed so that the whole surface thereof may, as much as possible, be subject to the direct action of the heat of the fire, and of the heated products of combustion passing therefrom. *Patent completed.*

2777. R. Pethney. *Improvements in machinery or apparatus for preparing, spinning, or doubling cotton, silk, and other fibrous materials, parts of which improvements are applicable for winding and other purposes.* Dated Nov. 5, 1861.

This consists, first, of a novel bolster, part of which is made of a globular or partly globular form, and fits a recess of a similar shape in the copping or spindle rail, there being a pin or projection to prevent it revolving with the spindle; This pin or projection may either stand out of the bolster and fit into a slot or notch in the rail, or it may project from the rail and fit a slot or recess in the bolster. There is also fitted on the upper or lower side of the rail, or other convenient part, a cup or other appliance to hold the bolster in its place; or the same effect is produced by entering a pin into a circular recess in the bolster. This arrangement enables the bolster to accommodate itself to any displacement or deviation of the stopping or moveable rail. Second, the invention consists in a self-acting lubricator, for lubricating the spindles. *Patent completed.*

2778. R. A. Brooman. *Improvements in steam generators and in furnaces for the same.* (A communication.) Dated Nov. 5, 1861.

This invention consists in fitting in fire boxes or furnaces of locomotive, marine, and other steam boilers an arched or dome-shaped water vessel, communicating with the boiler for its supply of water through pipes entering the bottom or lower part of the vessel, and with the steam space in the boiler through serpentine pipes carried from the top or upper part of the vessel. The invention also consists in forming an air passage outside the fire box or furnace, and in regulating the admission of air by means of a valve or valves, and causing it to enter both under and through the fire bars and fuel and over the fire. By preference the fire bars are formed in two sections; one, that upon which the fuel is received, is fixed, and the other is free to be moved by a weighted lever upon an axis upon which it is pivoted. The furnace door is fixed in the upper part of the casing which forms part of the air passage, in which a valve is placed to prevent any portion of the fuel entering and choking it. In some cases pipes traverse the crown or dome of the water vessel, and are wholly or partially opened or closed as required by a register plate worked by a handle extending outside the furnace. *Patent completed.*

2779. E. Bowra. *Improvements in the manufacture of elastic fabrics.* Dated Nov. 5, 1861.

The patentee claims, 1. The manufacture of elastic fabrics composed of India rubber, gutta percha, or other elastic gums, combined with chloride of sulphur and dry hydro-chlorate of lime, and the covering of linen, woollen, silken, or other fabrics. 2. The combination or covering of elastic cloth with the refuse or cuttings of leather or other fibrous material and waste vulcanized India rubber, gutta percha, or other elastic gums and chloride of sulphur and hypochlorite of lime. *Patent completed.*

2780. J. B. Love. *Improvements in the mode of combining together and securing to the sides of navigable vessels and water batteries, armour plates of iron or steel.* Dated Nov. 5, 1861.

This consists in rebating and boring the edges of armour plates, so that the same, when adjusted together closely, shall produce accurately fitting lap joints, that will leave both the inner side and outer side surfaces of the plates flush with each other. The plates have tapering or conical holes transversely through the lapping portions for the admission from the outer side of corresponding bolts, the outer ends of which bolts shall be flush with the outer side of the plates. The invention also consists in intervening along between the said edges of each connecting pair of the said plates, when the same are being applied as armour to the vessel or battery, a thin strip of soft compressible metal, gum cloth, tarred felt, or any other compressible and durable material. The invention also consists in fitting together the upper edges of the highest tier of plates, and the upper edge of the bulwark of the vessel, by means of an over-lapping projection or flange formed on the inner side of the plates at this part, and also in constructing and applying a copping rail, which will closely embrace the upper ends of the said flanged plates, and the upper edge of the bulwark, of a curved form in its transverse section, and firmly bolted to the parts which it covers, so that it shall form a powerful support to the bulwark of the vessel, and at the same time serve to deflect shot or shell. *Patent completed.*

2781. J. P. Bourquin. *Improvements in ornamenting the covers of photographic albums, books, writing cases, and other like articles.* Dated Nov. 5, 1861.

This consists in applying thereto decorations resembling inlaid woods, known as marqueterie and wood mosaics. This the inventor proposes to effect by printing upon veneers mosaics and other designs, and thereby imitating differently coloured wood arranged in patterns. *Patent abandoned.*

2782. S. Griffiths. *Certain improvements in the manufacture of iron.* Dated Nov. 5, 1861.

This consists in the manufacture of iron entirely free from sulphur, and this result is obtained as follows.—1. During the process of reducing the iron from the mine in the blast furnace. 2. In the conversion of crude iron into malleable iron in the process of puddling. The inventor effects this important object, in the first instance, by putting a chemical compound into the blast furnace with every charge of mine, which acts upon the mine, and particularly the metal when in a fused state, as an emetic, causing the metal to vomit or throw off all the sulphur otherwise incorporated with it to the top of the metal or fused mass in the furnace, to be collected and removed as most convenient and in the shape of solid sulphur, and, 3, during the conversion of crude iron into wrought iron in the puddling furnace, and this important result he effects by mixing about 1lb. weight of another chemical compound with each charge in the puddling furnace, while the iron is in a boiling state, which compound permeates in an instant the most minute or infinitesimal parts of the iron, and from its affinity it immediately combines with the sulphur, and instantly passes off through the superincumbent cinder in the shape of sulphuric acid gas to the chimney or draught way of the puddling furnace. *Patent abandoned.*

2783. H. Orth. *An improved soap.* Dated Nov. 5, 1861.

This consists of a mixture or combination of about 100 parts in weight of finely levigated clay, such as pipe clay, china clay, or other aluminous or siliceous earths; 20 parts of caustic alkali, such as caustic potash, caustic soda, or caustic ammonia, or the carbonates or bicarbonates of soda, potash or ammonia, corresponding to an equal amount of caustic alkali, and 20 parts of resinous matter, such as ordinary fine resin or any other resin of a similar nature capable of being saponified. These proportions may be varied according to the quality of the soap it is desired to obtain. In preparing this soap, the resinous and alkaline or caustic alkaline ingredients are mixed with about 50 parts by weight of water, and boiled together, ebullition being continued until the alkali and the resin are combined and saponified. The saponified mass is then mixed with the argillacious or earthy matters, the whole being worked into a homogeneous paste, which is afterwards dried, and which is then ready for use. *Patent completed.*

2784. G. T. Bousfield. *Improvements in electro-plating or depositing metals.* (A communication.) Dated Nov. 5, 1861.

This consists in the use of a solution of fused cyanide of potassa of great strength, in connection with a powerful galvanic current, whereby the patentee is enabled to plate iron and other metals rapidly and economically with copper, without the use of either sulphate or cyanide of copper, and without danger or inconvenience to the workmen. *Patent completed.*

2785. G. Davies. *Improvements in fire-arms and ordnance.* (A communication.) Dated Oct. 6, 1861.

This relates, first, to muzzle-loading fire-arms which have to be converted into breech-loaders, and consists, 1, in hinging a breech to the rear end of the barrel, which breech is so constructed that its upper portion may fit over an enlargement on the end of the barrel, in a manner which renders the breech incapable of moving longitudinally whe the cartridge is discharged. 2. In a device for retaining the lower portion of the breech in its proper position in respect to the end of the barrel. 3. In a device for locking the breech to the barrel, and readily releasing it therefrom. 4. In an inclined projection on the hinge piece, whereby the spent cartridge may be partially withdrawn on turning the breech from the barrel, preparatory to the insertion of another cartridge. The second part of the invention comprises various arrangements of breech-loading fire-arms, the details of which we cannot quote here. *Patent abandoned.*

2786. H. D. Brady. *Certain new and useful improvements in machinery for lasting and pegging shoes.* (A communication.) Dated Nov. 6, 1861.

This consists of a variety of peculiar mechanism for lasting and pegging shoes. The invention is not described apart from the drawings. *Patent completed.*

2787. A. Prince. *Improvements in furnaces for reducing zinc-ores.* (A communication.) Dated Nov. 6, 1861.

The patentee constructs an upper and lower set of mufflers, with suitable beds, in ranges of retorts placed one upon another, so that they cannot bend or burst and cause the furnace to become dirty. The foundation vault, hearth, chimney, and iron bands are arranged as in ordinary furnaces of half the power of production, except that a slight increase in their length is made. By arranging the mufflers in the furnace in a double range, the upper range resting on a bed placed on the lower range of mufflers, the production of zinc in a reducing furnace may be doubled, and a better quality of metal obtained than by the ordinary way of a single range of mufflers. The zinc is to be condensed from the mufflers in suitable recipients, and the sublimed zinc resulting from the process is to be collected in proper receivers. A great saving of fluid is effected by this invention, 150lbs. of coal being sufficient to reduce 100lbs. of worked zinc ores. *Patent completed.*

2788. W. Ramsell. *Improvements in the construction of boats, barges, buoys, and other like structures of metal, and in machinery employed therein.* Dated Nov. 6, 1861.

This invention consists in constructing metal boats, barges, buoys, and other like structures, by stamping the same from one or more plates of metal, by means of machinery, consisting of top and bottom dies or stamps and moulds, between which the plate of metal is pressed by steam or other gas, or by hydraulic pressure. *Patent completed.*

2789. F. H. Schroder. *Improvements in evaporating and in machinery employed therein.* Dated Nov. 6, 1861.

This invention is intended chiefly to apply to the evaporation of the liquid parts from sugar when in a state of syrup, in order to obtain it in a crystalline condition. It is, however, applicable to evaporative purposes generally. The invention consists in placing the syrup, or other matter to be evaporated, in an open pan heated by steam or hot water, let into a jacket or case, in which the pan is placed, and in causing a series of concentric cylinders, through which a blast or current of hot or cold air is forced, to revolve in the syrup, a portion of the cylinders being continually in the syrup and another portion revolving in the atmosphere. The cylinders are each formed with slots running in the direction of their length. *Patent completed.*

2790. F. G. Stuber. *An improved hygrometer for measuring the humidity of the atmosphere, dampness of beds, garments, and for other purposes.* Dated Nov. 6, 1861.

This relates to the application of cellular, porous, or scaly substances (as wood, wool, hair, silk, &c.) which have been rendered sensitive to humidity for measuring different degrees of the same. These substances, after being cleansed from dirt, grease, &c., are placed in solutions of certain salts or materials, which are either deliquescent at the time, or afterwards may become so (such as chloride of calcium, carbonate of potash, chloride of sodium), and by pressure with or without heat, made to imbibe into their minute pores portions of such salts or materials. These substances will swell or expand with moisture, and shrink or contract with drought, and this movement in a multiplied degree is made to express the various changes. *Patent abandoned.*

2791. S. Cockett. *Improvements in cop tubes.* Dated Nov. 7, 1861.

This consists in bending inwards the bottom of the tube, so as to obtain increased strength at that part, and clip the spindle at the bottom of the tube as well as at the top, and thereby dispense with the rings and buttons on the spindles. The inventor also causes the exterior of the tubes to be rough. *Patent abandoned.*

2792. J. Walmsley. *Improvements in looms for weaving.* Dated Nov. 7, 1861.

This consists in an improved arrangement of the working parts of the looms so as to be able to weave two pieces of fabric at the some time, so that each piece will have a proper selvage, and may be woven as wide as the reed space will admit. The patentee uses two warp beams, two cloth beams, two taking-up motions, two shuttles, one in two sets of healds, two temples, and two weft detectors. The pieces of fabric are one above the other, the two warp threads passing through the same reed, and the other ordinary parts of the loom are arranged to suit the requirements. *Patent completed.*

2793. W. E. Gedge. *Increasing the production of wool.* (A communication.) Dated Nov. 7, 1861.

Provisional protection has not been granten for this vention.

2794. A. W. Williams. *Improvements in the construction of boilers.* Dated Nov. 7, 1861.

This consists in constructing steam boilers entirely of tubes or tubular vessels, arranged so that each tube has perfect freedom to expand and contract by being attached only at one end to, and communicating with, a tube or tubular vessel, serving to connect a number of such tubes together, the other ends of such tubes being closed an simply steadied or held in position by suitable contrivances These tubes are placed either in a slanting or in a vertica position, with the closed ends either upwards or downwards, whilst the connecting tubes or tubular vessels to which they are attached are placed in a horizontal position. These tubes that are fixed with their closed ends upwards are filled only partially with water, the upper ends serving as steam chambers, whence the steam is conducted through pipes fixed inside the tubes into other pipes or equivalent passages fixed or formed inside the connecting tubes, whence the steam is conducted in the usual way to where it may be required. By this arrangement, not only is each tube or element of the boiler capable of expanding and contracting without in any way straining the connections, but any defective tube or tubes can be readily removed and replaced by another, or by others, without in any way interfering with the other connections. *Patent completed.*

2795. J. R. Wigham. *Improvements in apparatus for the manufacture of gas, parts of which are also applicable for cooking purposes.* Dated Nov. 7, 1861.

This consists in the peculiar construction or arrangement of a vertical retort for the manufacture of gas, and especially as regards domestic purposes, whereby the waste or surplus heat produced by such retort is made available for domestic or cooking purposes, the retort being heated by a circular or other shaped stove or furnace, so arranged that the top plate of the same may be used for cooking. *Patent completed.*

2796. S. Lepard. *Improvements in apparatus for heating and warming conservatories, green-houses, ferneries, orchard houses, or other buildings and rooms.* Dated Nov. 7, 1861.

This invention is carried into effect as follows:—Over a gas furnace, or over a series of gas burners or jets, the inventor places a small metal boiler, within which he introduces water. He connects this boiler by pipes with another vessel. The communicating pipes pass from the upper and under part of the boiler to the upper and under part of the other vessel, in which also water is placed; both the boiler and vessel have the requisite pipes for admitting water, and safety valves for letting off steam. The gas being lighted, the water in the boiler becomes heated, and a current is established between the water in it and that in the other vessel; the heat radiating from the latter raises the temperature of the building or compartment wherein it is placed. The apparatus may be fixed upon a stand, or mounted on a frame, or suspended from the ceiling, or in any other way. *Patent abandoned.*

2797. T. Schwartz. *A new air engine or air motor (termed recuperative.)* Dated Nov. 7, 1861.

The patentee claims, 1, the specified means for maintaining constant temperature in compression and expansion. 2. The generator containing liquids for transmitting heat by external action to the working of the cylinders. 3. So arranging the apparatus that a portion or branch current may be directed from the body of compressed cold air to be dilated to receive and convey so much heat as is to be acquired for the purpose from the furnace, while the rest of the main current is heated exclusively by the regenerator. 4. The use of the exhaust pump, as set forth, whereby the condensation incident to regeneration of heat is made available in securing vacuum action. 5. The means for assisting the operation of the regenerator by appropriating a portion of the heat to the feed current of the furnace through a special heater. 6. The interposition of an expanding receptacle in the return passage to the compression-pump, to accommodate the conditions of supply to those of demand in working the same air over and over again. 7. The means described, or any mere modification thereof, for controlling the working temperature of the engine, and checking the accumulation of heat. 8. Those certain peculiarities in the details of construction set forth and described with reference to the drawings. *Patent completed.*

2798. H. G. Gibson. *Improvements in apparatuses for drying hops, malt, grain, and other vegetable substances, part of which is applicable as a fan or blower.* (A communication.) Dated Nov. 7, 1861.

This invention consists, 1, of a box or case, surrounded with single or double jackets or envelopes, and containing inside at different levels two, three, or more shelves or tables, either formed of perforated louvre plates, which are acted upon by a rod or lever, or they are formed of perforated or open work plates. These shelves or tables run upon slides inside the case to allow of their being withdrawn through doors fitted for the purpose. At the lower part of the case a funnel or shoot is fixed through which the articles can be withdrawn. At the upper part and side of the case a hopper may be fixed, through which the articles may be fed on to the upper shelf, and from it to those below it. 2. Of a fan or blower, placed at the upper part of the case, and which is not described apart from the drawings. *Patent completed.*

2799. J. Hancock. *Improvements in the manufacture of looped fabrics, and in machinery to be employed therein.* Dated Nov. 7, 1861.

This invention of improvements in the manufacture of looped fabrics and in machinery employed therein, has reference to the ordinary straight frame now used for producing hosiery work. The improvements enable the patentee to make two or more courses of work in one complete motion of the frame, instead of only one course, as is now ordinarily done. The invention consists, 1, in an improved arrangement of instruments, carrying needles for working the needles backward and forward (the needles being operated upon for forming the loops by the jack and lead sinkers), and which arrangement he uses for producing the results now usually effected in the ordinary frame by the use of jack and lead sinkers; these instruments are formed of plates of iron, one to each sinker of the frame, with two needles cast into each plate (one needle only may be employed, when it is so desired), and are moved backward and forward by an inclined plane or planes. 2. In an arrangement of machinery for working the instruments and needles first referred to, when it is desired either to narrow, widen, or figure by these instruments, and whereby no time is lost in performing these operations. The instruments before referred to are, when used for the purpose of narrowing or widening, raised up or drawn out at the back to throw the needles out of work, and thus the width of the material may be regulated; any of the needles may be operated upon in the same way for producing false loops when figuring of the work is required, these instruments being raised or drawn out by levers. 3. In the use of two or more bars carrying feeders for laying the threads under the sinker nibs, or on hooks, or on needles, and carrying one, two, or more inclined planes, by means of which combination two or more courses of the fabric can be made at one time. This working of more than one course at one time causes a double loop to be formed on the selvage of the fabric. And 4. In the combination of the parts hereinbefore described to form an improved frame for making looped hosiery goods, whereby the whole work may be twice (or oftener as may be required) commenced and completed in the space of less than six inches, thus leaving the rest of the frame at liberty for narrowing, figuring, or widening, without losing time in the manufacture of the fabric. *Patent completed.*

2800. W. A. Shepard. *Improvements in preparing and treating gutta-percha and india-rubber.* Dated Nov. 7, 1861.

We cannot here with advantage give space to the voluminous details of this invention. *Patent completed.*

2801. J. Barrow. *Improvements in the manufacture of benzole, naptha, napthaline, annaline, and carbonic acid.* Dated Nov. 7, 1861.

This invention consists in treating coal directly for the manufacture of the above-named products (and in avoiding as much as possible the production of gas), instead of the coal tar of gas works. The details of the process are voluminous. *Patent completed.*

2802 T. C. Darby. *Hoeing growing crops and ploughing.* Dated Nov. 1, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2803. B. Dobson and J. Clough. *Certain improvements in machinery for combing, preparing, and spinning cotton and other fibrous substances.* Dated Nov. 8, 1861.

These improvements in machines for combing, consist in the application thereto of self-acting stop motions, whereby the machinery may be stopped when a sliver breaks between the feeding laps and the spouts, or between the taking-off rollers and the funnels, or between the funnels and the coiler. The improvements in machinery for preparing and spinning consist in an improved mode of constructing the cap bars, by which the top rollers of the drawing rollers employed in such machinery are held in their places. *Patent completed.*

2804. H. Montucci. *Goffering or embossing stuffs in high relief.* Dated Nov. 8, 1861.

The patentee claims the exclusive use and manufacture of moulds, containing a moveable piece calculated to produce wedge-like types, the casting of moveable wedge-like types by the mould as related, and the taking of the impressions of the design on another roller by drying paste, the whole essentially as described. *Patent completed.*

2805. C. W. Siemens. *The construction of a certain destructive weapon to be used in naval warfare.* Dated Nov. 8, 1861.

The object here is the construction of a weapon which is to approach an enemy's ship or works of coast defence in perfect safety to within a distance of from ten to twenty yards, and to discharge against it below the surface of the water a bolt weighing from fifteen to twenty hundred weight, with a velocity not exceeding 400 feet per second, which bolt or projectile is made to explode after it has struck, so as to produce an irreparable breach in the side of the vessel from three to six feet below the water line. *Patent abandoned.*

2806. J. Tyler. *Improvements in the manufacture of clarionets.* Dated Nov. 8, 1861.

This relates to the production of C sharp in the third place, and F sharp on the third ledger line below, and consists in so arranging the keys that the C sharp in the third space, and F sharp on the third ledger line below, are produced by one finger of the left hand, instead of being produced as hitherto by the fourth finger of the left hand and the fourth finger of the right hand together. *Patent abandoned.*

2807. W. Clark. *Improvements in railway signal apparatus for the prevention of the collision of trains.* (A communication.) Dated Nov. 8, 1861.

This invention relates to electrical apparatus, and consists of two kinds of apparatus, the first being placed on the line and the second near stations. The locomotive in passing a signal disc oscillates a treadle or lever which turns the disc to red, and indicates the line blocked, in which position the disc remains until the locomotive reaches the next disc, where it oscillates a second treadle or lever, and turns the second disc to red, but here the movement of the disc establishes an electric current which controls the first disc, and returns it to the indication of "line clear." The second apparatus is intended to indicate throughout a sufficient range of that point in what position the disc is which commands the entrance and exit of the station. For this purpose a small repeating or controlling signal post is placed in the position in which it is wished to control the movements of the trains, similar to the posts before described, and furnished with treadles worked by the foot, which serves the same as for the other posts to turn the controlling disc. This apparatus is in electrical communication with the first disc of entry and exit to the station, so that it repeats all their movements, and of which it is a counterpart. *Patent abandoned.*

2808. J. H. Johnson. *Improvements in the treatment of carpets.* (A communication.) Dated Nov. 8, 1861.

It is here proposed by the inventor to apply to the back of the carpet to be treated one or more coats of drying oil, varnish, india-rubber solution, or other highly adhesive and siccative composition or cement, which application has the effect of firmly uniting the woollen pile or loops with the ordinary linen warp, forming the back of the fabric, and so preventing their disengagement or detachment therefrom. *Patent completed.*

2809. J. Byrne. *Improvements in machinery or apparatus for scutching and refining flax, hemp, jute, and other fibrous substances.* Dated Nov. 8, 1861.

This invention is carried into effect in the following manner:—In the circumference of a wheel revolving about a fixed axis the patentee forms transverse grooves or slots, and into each groove or slot he fixes an arm or projection from the end of a blade of peculiar construction formed of wood, metal, or other suitable material. That edge of the blade which first comes into contact with the material is formed sharp, and upon the side of the blade which is presented to the material, and towards the back of the blade, he forms a row of projecting scrapers of a semicircular form, resembling finger nails; and above the scrapers, and upon the back of the blade, he fixes a projecting plate or scraper of a plane rectangular form. The substance to be operated upon is placed in an opening in front of a carriage, whereupon it is brought into contact with the blades, and is held firm in the opening by two plates attached to the front of the said carriage, and acting like a vice, one of the said plates being made movable for the admission and removal of the substance under operation. Diametrically opposite that part of the wheel to which the substance is presented, he fixes a revolving brush of a circular form; this brush pressing against the blades, removes from them the tow or waste, whilst a fixed scraper pressing against the brush, keeps the brush clear and clean. *Patent completed.*

2810. A. B. Berard. *Improvements in separating metals from their ores.* Dated Nov. 8, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2811. D. Cowan. *An improved mode of constructing pneumatic subaqueous tubes for passenger or goods traffic, and certain machinery for the manufacture of the same.* Dated Nov. 9, 1861.

This consists in constructing subaqueous tubes of solid or hollow staves of iron, wood, or other material. The staves are held together by a continuous iron band, wrapped spirally round the tube, or by hoops of iron shrunk on. The staves, or a portion of the staves, being hollow, the tube can be weighted to the specific gravity of the water in which it is submerged, to remain at any desired level, by the admission of water within the staves, and by extracting the water the tubes will be made to rise. *Patent completed.*

2812. M. Morgan. *An improved gaiter or covering for the leg.* Dated Nov. 9, 1861.

This improved covering for the leg is similar to a gaiter or knickerbocker, but requires no strap, button, buckle, or other fastening, as it is made of a supple and elastic material. It is passed over the boot or shoe before they are put on, and fits neatly over the instep, and together with the shoe has the appearance of an entire boot. *Patent abandoned.*

2813. G. Simpson. *Improvements in boring apparatus, such as is used in mining purposes.* Dated Nov. 9, 1861.

This invention is not described in detail apart from the drawings. *Patent completed.*

2814. R. McNair. *Improvements in casings for stitching machines, and in adapting the same for writing.* Dated Nov. 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2815. F. H. M. C. D. C. F. De Lacombe. *Improvements in generating hydrogen gas for illuminating or other purposes, and in apparatus used thereby.* Dated Nov. 9, 1861.

This consists in projecting water in one or more small jets into an iron or other suitable vessel, kept at a suitable heat by a bath of molten metal, and farther superheating the steam thus produced by causing the same to come in contact with highly heated metallic parts, and finally introducing this super-heated steam, with or without the addition of atmospheric air, into a highly heated retort, partly filled with carbonaceous or other matter, suitable for decomposing the steam; or, if air be mixed therewith, of the steam and air. Part of the super-heated, in conjunction with a draught of air, is projected on the fuel in the fire-place of the retort, and of the steam generating and super-heating vessels. *Patent abandoned.*

2816. S. Haour. *Improvements in the manufacture of hoes, adzes, or other articles.* Dated Nov. 9, 1861.

This consists in a method of construction whereby the eye and blade of the hoe or adze is made from a single piece of iron without welding. The metal is rolled into strips or bars, and punched with holes at suitable distances, so that the strips or bars may be cut up into various pieces. These pieces, after being properly heated, are placed on a perforated anvil or die plate, upon which a hammer falls, and the impression is thereby made for the eye. The piece of iron is then taken to a plater, who draws it to a suitable thickness; it is next placed on a perforated die, and receives the exact form or size required by the action of a corrugated punch. *Patent completed.*

2817. J. Fisher. *Improvements in apparatus for indicating or regulating the passing of railway trains.* Dated Nov. 9, 1861.

The patentee claims the use or employment of a cylinder for containing fluid, fitted with a piston or bucket, in manner and for the purpose described, by which, through the intervention of a curved lever-arm, headle, or pressure-piece, or their mechanical equivalents, and the necessary intermediate connections, the passing of an engine or train is made to act upon the piston or bucket, and elevate, project, or bring into operation a curved lever, or its mechanical equivalent, for operating upon a whistle or other audible signal fitted upon the engine, tender, or other part of the next succeeding or following train, and by the gradual unsetting of the apparatus, corresponding with the lapse of time, the time which has elapsed since the passing of the previous train may be approximately measured and recorded upon the engine of such succeeding train, as described. *Patent completed.*

2818. S. W. Campain. *Improvements in apparatus for stacking straw and other agricultural produce.* Dated Nov. 9, 1861.

Here an endless rope, strap, or band is used, to which is attached a series of receivers or holders, which are alternately brought to the end of a thrashing machine or other place, where the receivers or holders are fitted in succession, and are then brought over the stack and tilted so as to discharge the contents. *Patent abandoned.*

2819. R. A Brooman. *Improvements in obtaining alkaline phosphates.* (A communication.) Dated Nov. 9, 1861.

The process, the subject of this invention, is applicable to all mineral and animal substances containing phosphate of lime, such as bones, animal black, coprolites, phosphates of lima (apatite or phosphorite). The substances are treated with a quantity of sulphuric acid in proportion to their richness in phosphate and carbonate of lime; soluble phosphates of lime are obtained, which are separated by washing. If the acid solution thus obtained contains a small proportion of iron, it can with advantage be converted into Prussian blue through the action of prussiate of potash. The acid liquids are separated and evaporated, and when they attain a certain degree of concentration they may be considered as a powerful acid; in fact it is a mixture of free sulphuric and phosphoric acids, containing sulphate and phosphate of lime, as well as sulphates and phosphates of potash, proceeding from the decomposition of the prussiate. If, then, to this acid liquor be added a salt of potash or soda formed by a volatile acid (hydrochloric, carbonic, sulphuric, or nitric acid for example) and evaporation be continued to perfect dryness, there will be two products: 1st, a volatile product, which will be the acid of the decomposed salt; 2nd, a solid and fixed product, which will be a phosphate of soda or potash. *Patent completed.*

2820. R. A. Brooman. *An improved spinning toy.* (A communication.) Dated Nov. 9, 1861.

This toy is constructed as follows:—A spherical ball is fixed loosely upon a spindle which passes through and is a fixture with a wheel, the rim of which may be round, square, flat, or of any other form, and is united to the boss by curved arms. A string is wound upon a grooved collar fast on the spindle, and by rapidly withdrawing the string the toy is made to spin. Sometimes the sphere is repeated below as well as above the wheel. *Patent abandoned.*

2821. E. Lovsell. *Improvements in matchboxes or cases.* Dated Nov. 9, 1861.

This consists in forming these articles of porcelain, parian marble, or other earthenware, and in making a portion of the exterior of the article with a roughened surface, on which the matches may be rubbed for igniting the same. *Patent completed.*

2822. W. E. Newton. *Improved apparatus for manufacturing and containing gaseous liquids.* (A communication.) Dated Nov. 9, 1861.

This apparatus consists simply of one vessel made of glass, porcelain, or other suitable material, in which are placed the water and chemical salts necessary to produce the gas with which it is intended to impregnate the liquid. An aperture is made either at the top, bottom, or other convenient part of the vessel, and a recess is provided to receive a small perforated vessel in which the salts are placed. This small vessel is secured in its place by a screw cover or capsule, and the small vessel being perforated the water from the large containing vessel may be allowed to run among the solid salts, and cause the gas to be disengaged and percolate through the water. A tap connected with a tube which extends to the bottom of the containing vessel, will serve to draw off the gaseous liquid from the vessel when required. *Patent completed.*

2823. A. Turner. *Improvements in knitting machinery.* Dated Nov. 9, 1861.

This relates to circular knitting machines, and the object of the invention is to produce in such machines fabrics with longitudinal strips or patterns of various colours, or different kinds of work. This is effected by the use of threads of different colours, and by dividing the needles into two or any desired number of sets, each set being made to operate upon its particular thread, from which such needles will form loops or work, the operations of the set of needles being so arranged and combined that they shall produce a single but partly coloured fabrics. Wheels are used having teeth or notches constructed so as to admit of these teeth acting alternately as sinkers and pressers. *Patent completed.*

2824. W. Clark. *Improvements in portable and other filters.* (A communication.) Dated Nov. 9, 1861.

This filter is formed of two reservoirs of cloth coated with india-rubber, separated by a filtering substance contained between two metallic plates pierced with holes. This arrangement renders the apparatus portable, as the reservoirs can be folded. *Patent completed.*

2825. P. O'Railly. *An apparatus to enable tailors to work at an ordinary table without sitting.* Dated Nov. 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2826. W. Tongue. *Improvements in processes for treating, preparing, and combing certain fibrous materials, and in the machinery or apparatus employed for these purposes.* Dated Nov. 11, 1861.

The details of this invention are too voluminous to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2827. D. Y. Stewart. *Improvements in the manufacture of cast-iron pipes and similar articles.* Dated Nov. 11, 1861.

This consists in ramming up the outer mould for a pipe or similar article upon a pattern constructed so that the whole, or a part thereof, may be contracted or collapsed to permit of its removal from the mould longitudinally without rubbing injuriously upon the mould surface, and without its being required to open or divide the mould. The collapsible pattern may be constructed according to any pattern, such as is at present in use in making collapsible core bars. The invention also consists in a rotating tool for removing the cores from the castings. *Patent completed.*

2828. G. Leslie. *Improvements in pens and writing instruments.* Dated Nov. 11, 1861.

This consists in manufacturing pens of hardened caoutchouc, gutta-percha, or gums known as vulcanite or ebonite. *Patent abandoned.*

2829. W. Clark. *Improvements in safety lamps.* (A communication.) Dated Nov. 11, 1861.

This relates to safety lamps for use in mines, gasworks, distilleries, &c., and consists, 1, in so constructing the lamp that when once lighted and closed it cannot be opened without completely extinguishing the light. 2. The metal gauge is screwed to the lamp, instead of being carried by the suspending part. 3. The exterior and bottom of the lamps are free from anything that might be injured by blows, the mechanism being all enclosed, so that the lamp is incapable of getting out of order by shaking. 4. The lamp being constructed on purely mechanical principles is not subject to disarrangement by rough usage. *Patent abandoned.*

2830. J. J. Sherlock. *Improvements in gas-meters.* Dated Nov. 11, 1861.

This invention is intended to render a gas meter capable of delivering as near as may be the quantity of gas within the hour for which it is constructed, and at the same time of correctly measuring the quantity of gas passed through it, although a less number of lights have been burning than the meter is arranged to supply. The patentee, for this purpose, applies to a meter the apparatus hereafter described, so as to ensure the meter working at a pressure not exceeding a regulated and determined maximum pressure. The apparatus is composed of a bent tube, in which is placed any suitable fluid, one end of this tube is connected with the valve box, into which the supply of gas first enters, consequently, the fluid in the bent tube will be subjected to the pressure of the incoming gas. The other end of the bent tube has a float connected with a lever so arranged as to tend to close the inlet valve when the pressure of the gas depresses the leg in the bent tube, which is connected with the valve box, and so raises the fluid and the float in the other leg of the bent tube. The gas after passing the inlet valve flows to a second valve chamber, where, in the case of wet gas-meters, there is a second valve, acted on by the ordinary float of the meter. By the means the maximum pressure at which the gas shall pass into a meter may be readily regulated. *Patent completed.*

2831. G. F. Wilson and G. Payne. *Improvements in treating fatty and oily matters.* Dated Nov. 11. 1861.

This consists in treating fatty and oily matters with nitrous fumes, and then further subjecting them to the action of water at a high temperature and pressure; or, after subjecting them to nitrous fumes, to distil the products in like manner to that described in the specification of a former patent of the patentees, or to the combined action of the said water decomposition and distillation. *Patent completed.*

2832. A. Shannon. *An improved method of accelerating projectiles.* Dated Nov. 11, 1861.

This consists in dividing the charge of powder into sections by perforated diaphragms, whereby the ignition or explosion of the sections of powder takes place successively, thereby accelerating the velocity of the flight of the projectile. *Patent abandoned.*

2833. C. O. Crosby. *Improvements in the manufacture of pointed trimming, and in the machinery for manufacturing pointed trimming.* Dated Nov. 11, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2834. W. J. Hay. *Improvements in protecting iron and wooden ships, caissons, dams, and other wooden and iron structures from decay and from fouling by vegetable and animal matters, and in preparing the materials employed therein.* Dated Nov. 12, 1861.

This invention consists in an improved method of treating the oxides of copper and other metals to prevent the uncertainty of their action by imperfect or not uniform application when used for keeping ships' bottoms or other structures free from animalculæ and other animal and vegetable matters, also when used to preserve woods and other materials from decay and the ravages of insects. For these purposes the patentee grinds in linseed oil the black or protoxide of copper, and then boils it with linseed oil until it is reduced to the suboxide, and by thus oxydising and oxydating the oil he forms a quick drying cupreous oil, which suspends the oxide in the form of a paint or varnish. To this he sometimes adds a small portion of silver or other metals and oxides. In those cases where greater durability is required from ships being on foreign stations or not able to be docked periodically, the inventor adds to the above mentioned paint an additional quantity of finely ground suboxide of copper; or when the paint is required to be black, he adds the blackoxide of copper in the same manner. The paint or varnish may be thinned by spirits of turpentine, naphtha, or any other cheap spirits to any degree of consistence desirable. *Patent completed.*

2835. R. Bellis. *An improved method of laying wood floors.* Dated Nov. 12, 1861.

This invention consists in fixing at one side of the joists on which the floor is to be laid angle iron, one face of which is made to project from the joist below the level thereof, and in inserting into the underside of each deal or board composing the floor T headed screws, one arm of which on the boards being laid becomes engaged under the projecting flange of the angle iron. The ends of the boards are wedged up against the side of the room or building being floored. *Patent completed.*

2836. J. Davidson. *Improvements in apparatus for communicating between the passengers and the guard and engine-driver of a railway train.* Dated Nov. 12, 1861.

Here each compartment of the railway carriage is provided with a handle attached to a cord passing over a pulley fixed to a shaft extending the length of the carriage; these shafts are coupled to connect all the carriages of the train by a system of levers acting as a universal joint; but any other suitable covering may be used. The shaft at the guard's van is connected to a bell or other alarum, and the shaft of the tender or locomotive is connected to the steam whistle or other alarum by this arrangement; when a passenger pulls the handle, the attention of the guard and engine-driver is instantly arrested, and as the action on the handle pushes out a slide or flag, the guard can ascertain from what compartment the signal has been given. By turning the shaft partly round, the guard can, at any time, call the attention of the engine-driver, and, if requisite, the engine-driver can in like manner communicate with the guard. *Patent completed.*

2837. G. Davies. *Improvements in bleaching cotton and other textile fabrics or materials, and in the apparatus employed in such process.* (A communication.) Dated Nov. 12, 1861.

This consists, principally, in submitting the fabric or materials to be bleached to all the successive operations necessary for bleaching in the same vessel, without displacing the goods or materials, instead of removing them from one vessel to another, as ordinarily practised. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Feb. 8, 1862.

334. J. A. Knight, 4 Symond's-inn, Chancery-lane. Improvements in washing machines. (A communication.)

Dated Feb. 21, 1862.

465. R. and W. E. Pickin, Birmingham, carriage builders. Improvements in the manufacture of carriage bodies.

Dated March 27, 1862.

843. J. Haworth, 22 Southampton-street, Bloomsbury, gentleman. An improved method of conveying telegraphic messages and signals by means of electricity without the intervention of any continuous artificial conductor.

849. W. F. Henson, 15 New Cavendish-street, Portland-place, C.E., and H. H. Henson, 13 Parliament-street, C.E. Improvements in wicks for candles and lamps.

Dated April 1, 1862.

921. H. Lorenz and T. Vette, Berlin. Improvements in filters.

Dated April 2, 1862.

934. W. Clark, 53 Chancery-lane, engineer. An improved apparatus for manifold writing. (A communication.)

Dated April 3, 1862.

947. J. Lee, Traction Engine Works, Lincoln. Improvements in traction engines and boilers for traction, locomotive, and other purposes.

Dated April 7, 1862.

985. G. Haseltine, 100 Fleet-street, American barrister. Improvements in lamps especially designed for burning hydro-carbon oils. (A communication.)

989. J. Carrington, Queen's-gate-mews, Kensington, groom. Improvements in the form of bricks, and in the arrangement thereof for paving stables and stable yards.

Dated April 8, 1862.

993. H. Levinstein, 2 Pinners-court, Old Broad-street. Improvements in lustreing silk, and in machinery or apparatus employed therein.

Dated April 11, 1862.

1041. E. H. Carbutt, Bradford, engineer. Improvements in pistons.

Dated April 21, 1862.

1152. J. Combe, Belfast. Improvements in machinery for hackling flax and other fibrous substances.

Dated April 22, 1862.

1169. C. E. Elliott, 5 Aldermanbury-postern. Improvements in the preparation of dried yeast. (A communication.)

Dated April 25, 1862.

1209. J. F. Brunet, 21, King William-street, Strand. Improvements in the manufacture of fringes, and in apparatus connected therewith. (A communication.)

Dated April 29, 1862.

1252. W. Clark, 53 Chancery-lane, engineer. An improved method of preserving animal and vegetable substances. (A communication.)

1263. M. Henry, 84 Fleet-street. Improvements in apparatus for aerating liquids, and in fastenings for the said apparatus and for other articles. (A communication.)

Dated April 30, 1862.

1268. G. Davies, 1 Serle-street, Lincoln's-inn. An improved electric apparatus applicable to various useful purposes. (A communication.)

Dated May 5, 1862.

1328. H. Allman, Bedford-row, C.E. Certain improvements in the construction of locks.

1336. R. Bushby, Little Hampton. An improved method of lifting or lightening ships for entering shallow harbours or docking and other purposes.

1338. P. L. A. T. Sourbe, Condom. An improved method of maturing spirits and wines.

Dated May 7, 1862.

1360. P. H. Colomb, Her Majesty's Dockyard, Devonport, lieutenant. Improvements in arrangements and apparatus for signalling.

1362. T. H. Hopwood, Hulme, Manchester, engineer. Certain improvements in the means or apparatus to be employed for the purpose of raising sunken vessels or other submerged bodies, and also in the application of a self-acting balance and regulator to the pontoons used therein.

1364. N. Wood, Hetton Hall, Durham, coal owner, and J. Stockley, Newcastle-on-Tyne, engineer. Improvements in apparatus for grinding, smoothing, and polishing plate glass.

1370. J. Haley, Rochester-villa, Battersea, Surrey, gentleman. Improvements in armour plates for ships, boats, and batteries.

Dated May 8, 1862.

1382. G. C. Grimes, 8 Wandle-terrace, South-street, Wandsworth. Improvements in the manufacture of cigar lights, splints, matches, and tapers or vestas, and in machinery or apparatus employed therein.

Dated May 9, 1862.

1390. T. K. Mace, Birmingham, hatter. Improvements in guards or protectors for hats and other coverings for the head.

1394. T. Fawcett, jun., Lisburn, Ireland. Improvements in plaited fabrics for shirt fronts and other uses, and in the mode of and mechanism for manufacturing the same.

1396. T. Welton, 13 Grafton-street, Fitzroy-square. Improvements in the preparation of beverages in connection with brewing.

1398. F. J. Bolton, Bolton-row, May-fair, captain. Improvements in telegraphing for naval and military and other purposes, and in the apparatus connected therewith.

Dated May 10, 1862.

1402. J. F. Milward, Redditch, Worcester, commission merchant. Improvements in breech-loading fire-arms. (A communication.)

1404. R. Moore, Cannon-street West, engineer. Improved apparatus for indicating the presence, position, or accumulation of liquids, gases, or vapours, and apparatus for preventing danger or damage consequent thereon.

1406. J. T. Cooke, Leicester, batten maker. Improvements in battens used in weaving.

1408. H. D. Taylor, Huddersfield, manufacturer, and E. Robinson, manufacturing, analytical, and consulting chemist. Improvements in piece-dyed woollen fabrics, or fabrics composed of wool in combination with other fibrous substances.

1410. W. H. Ronald, Montrose, Forfar, N.B., china merchant. Improvements in apparatus for signalling and indicating the position of shots in rifle practice.

1414. H. W. Sambridge, Birmingham, manufacturer. Improvements in sliding chandeliers, gasaliers, and other pendent lamps.

Dated May 12, 1862.

1416. J. Milnes, Gloucester, contractor. Improvements in portable apparatus for exercising the human body.

1418. W. Clark, 53 Chancery-lane, engineer. Improvements in smoke consuming fire-grates. (A communication.)

1420. C. J. Harris, 20 King William-street, Charing-cross, publisher. Improvements in the manufacture of detector, season, or non-transferable tickets.

1422. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in casting metals, and in the moulds or cores employed therein. (A communication.)

1124. H. Cartwright, Dean Broseley, Salop, gentleman. Improvements in propelling and steering screw steam vessels.

1428. J. L. Wilson, St. John-street, Smithfield. Improvements in calendering woven fabrics, and in the apparatus employed for this purpose.

1430. E. P. Lansky, Nottingham-street Sheffield, merchant's clerk. An improved mode of and apparatus for working railway carriage brakes.

Dated May 13, 1862.

1432. S. B. Ardrey, Birmingham, machinist, and S. Beckett, Oldham, spindle-maker. Improvements in machinery or apparatus for manufacturing spindles, part of which apparatus is also applicable to grinding and polishing other articles.

1436. J. B. Sardy, New York, merchant and shipowner. Improvements in the construction of ships of war and other vessels.

1438. A. Wormull, Old Fish-street, City, surgical instrument maker. Improvements in trepanning instruments.

1410. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the purification of colza, rape, and other oils. (A communication.)

1442. J. Sivewright, Ravenhead, St. Helens, Lancashire, plate glass manufacturer. Improvements in the manufacture of polished plate glass.

1446. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in louvre blinds or shutters. (A communication.)

Dated May 14, 1862.

1450. C. T. Porter, 100 Fleet-street, engineer. Improvements in steam engine indicators. (A communication.)

1452. F. Tolhausen, C.E., 17 Faubourg, Montmartre, Paris. Improvements in the manufacture of velvets. (A communication.)

1456. A. Smith, Mauchline, Ayr, N.B., gentleman. Improvements in balances for weighing letters and other documents.

1458. H. G. Delvigne, 26 Rue St. Dominique, Paris, gentleman. Improvements in fire-arms.

1460. J. C. Brant, 69 Forston-street, City-road-basin. Improvements in the construction of armour plated ships, and in cements or compositions for uniting iron to iron, and for uniting other substances, which compositions may also be used for caulking and for coating ships' bottoms.

Dated May 15, 1862.

1462. J. Fletcher and J. W. Fuller, Salford, engineers and tool makers. Improvements in machinery for rolling bending, and planing metals.

1464. G. H. Sanborn, 100 Fleet-street, gentleman. Improvements in machinery for spinning. (A communication.)

1466. J. P. Jouvin, Rochefort-sur-Mer, France, medical officer. An improved process for preserving iron-plated and other vessels and metallic articles from oxidation, and preventing ships' bottoms from fouling.

1468. W. Sissons, Kingston-upon-Hull, manufacturer of steam pile driving machinery. Improvements in machinery for driving piles by means of steam hammers.

1170. J. Stone, High-street, Deptford. Improvements in Downton's ship bilge pumps and fire engines

1472. J. Wright, 42 Bridge-street, Blackfriars, C.E. Improvements in machinery for digging, excavating, and removing earth, gravel, and such like substances. (A communication.)

1474. C. Tress, hat manufacturer, Blackfriars-road. Improvements in the manufacture of hats, helmets, bonnets or caps.

1476. C. Girardet, Vienna, manufacturer. An improved construction of buckle.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

1490. N. Ames, Saugus, Essex, Massachusetts. A new and useful self-feeding card printing press. Dated May 16, 1862.

1505. E. J. Bridell, Temple, barrister-at-law. Improvements in the manufacture of substances artificially coloured, veined or mottled, like marbles or other substances. Dated May 17, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

91. T. Soar, J. Belshaw, and M. Soar. Knocker.
92. J. Parker, J. Wells, and B. Wells. Steam engines.
108. T. Harrison and J. G. Harrison. Ploughs.
113. W. Cleland. Treating and utilizing materials.
114. T. Timmins and T. Simmons. Bath.
130. J. Tow. Stoves or fire-places.
139. T. Roberts and J. Dale. Manufacture of gunpowder.
145. A. Lamb, and J. White. Life boats.
146. J. Bird. Crank axle.
154. J. Bate. Machines for corking or stopping the mouths of bottles.
157. J. H. Rawlins. Manufacture of paper. (A communication.)
159. R. A. Brooman. Sweeping machines. (A communication.)
160. W. Burgess, Reaping and mowing machines.
161. M. Henry. Applying electricity to horology. (A communication.)
161. I. Roberts. Hydraulic motive power engines, and meters.
165. F. W. Gerish. Printing presses.
167. A. J. Beer. Steam valves.
172. J. Wallace. Reaping machines.
184. W. Clark. Manufacture of artificial flowers, leaves, and fruit. (A communication.)
200. F. J. L. Lefort. Safety lock.
203. A. Samuelson. Hydraulic presses.
205. J. Lillie. Protecting ships' bottoms.
209. W. Orr. Manufacture of sugar.
236. J. B. Harby. Preserving electric telegraph cables and wires.
249. W. Davies. Cutting corks and bungs.
252. A. Lahousse. Wheels.
261. J. Hargreaves. Pipes or tubes.
282. L. Hill. Armour plating.
288. W. Clark. Preserving and colouring wood. (A communication.)
328. W. Clark. Preserving timber, which are particularly applicable to the timbers of ships or other maritime structures. (A communication.)
339. M. A. F. Mennons. Vapour baths. (A communication.)
447. G. T. Bousfield. Protecting boilers, tanks, and vats. (A communication.)
481. G. J. Oram. A revolving pendant.
484. M. A. F. Mennons. Gas burners. (A communication.)
606. T. Hack and A. E. Carter. Screw cocks.
806. G. Hartshorne, D. G. Ward, and W. Woolley. Punching or perforating metal plates or sheets.
870. R. Lublinski. Jointing crutch hooks.
967. W. E. Newton. Ships' pumps. (A communication.)
1070. J. Dargue. Combing wool.
1161. J. C. Amos. Apparatus for supplying surface condensers with water.
1199. J. F. Allen. Slide valves.
1210. R. C. Mansell. Wheels.
1220. W. Hale. Rockets.
1228. J. E. A. Gwynne. Centrifugal pumps.
1340. J. H. Johnson. Steam generators. (A communication.)
1342. B. Cooke. Cutting turf.
1348. J. Clarke and J. Richmond. Looms.
1380. P. Tate. Furnaces. (A communication.)
1422. J. H. Johnson. Casting metals. (A communication.)
1490. N. Ames. Printing press.
1505. E. J. Bridell. Substances artificially coloured.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated May 23, 1862.

2981. F. F. Dumarchey.
2991. W. Clark.
2995. W. Rowan.
3002. P. Spence.
3008. L. H. C. J. Carle.
3026. R. A. Rust.
3209. W. L. and W. Allchin.
3257. W. E. Newton.
3269. W. H. Bailey.
475. G. T. Bousfield.
667. W. H. and F. C. W. Latham.
829. J. T. Loft.
844. W. Greenway.

Dated May 27, 1862.

2122. H. Nelson, J. Carr, and G. Harrison.
3019. J. Cooper and C. Garrood.
3022. J. Wakenell.
3025. T. W. G. Treeby.
3028. J. H. Glew.
3030. J. Leach.
3032. J. L. Field.
3035. W. E. Gedge.
3042. R. Kennedy and J. Armstrong.
3055. M. Henry.
3057. A. Woodward, E. Woodward, and W. Woodward.
3058. J. and W. H. Bailey.
3108. W. H. Tooth and W. Yates.
3120. J. D. Jobin.
3150. E. Cajot.
3162. R. Shaw.
3214. J. H. Johnson.
38. J. Coryton.
510. J. Whitworth.
700. J. Kent.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1240. J. Valda.
1268. C. P. Moody.
1270. F. J. Bramwell.
1272. N. S. Dodge.
1279. G. D. Jones.
1289. R. A. Glass.
1350. G. H. and H. R. Cottam.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1139. I. J. Silbermann.
1167. J. A. Longridge.
1170. J. Park.
1195. W. S. Young.
1199. C. W. Harrison.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending May 21, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2505	1 0	2511	0 11	2517	0 3	2523	0 6	2529	0 3	2535	2 0
2506	0 3	2512	0 7	2518	0 3	2524	0 10	2530	1 4	2536	2 0
2507	1 4	2513	0 3	2519	0 10	2525	0 3	2531	3 9	2537	0 3
2508	0 10	2514	1 9	2520	0 8	2526	0 3	2532	0 3	...	...
2509	0 3	2515	0 3	2521	0 6	2527	0 3	2533	0 10	...	...
2510	0 4	2516	0 9	2522	1 1	2528	0 10	2534	0 7	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, May 29, 1862.

		£ s. d.		£ s. d.	nett
IRON:					
Rails in Wales and North of England	pr. ton	5 0 0	to	5 5 0	„
Welsh Bars, in Wales	„	5 5 0	„	5 7 6	„
Staf. Bars, at the Works	„	7 0 0	„	7 5 0	„
„ Hoops	„	7 10 0	„	8 0 0	„
„ Sheets, Singles	„	9 0 0	„	10 5 0	„
„ Nail Rods	„	5 15 0	„	6 10 0	„
„ Boiler Plates	„	8 0 0	„	8 10 0	„
Scotch Pig, M. Nos. Warrants, at Glasgow	„	2 10 6	„	2 14 6	nett
Do. No. 1, Good Brands	„	2 11 6	„	2 15 0	„
Scotch Bars	„	7 5 0	„	7 15 0	„
Swedish Bars, in London	„	10 10 0	„	11 0 0	„
COPPER:					
Sheet and Sheathing	per lb.	0 0 11	„	0 0 0	3
Tough Cake and Tile	pr. ton	98 0 0	„	0 0 0	„
Best Selected	„	101 0 0	„	0 0 0	„
Australian	„	99 0 0	„	0 0 0	„
South American	„	0 0 0	„	0 0 0	„
Yellow Metal Sheathing	per lb.	0 0 9	„	0 0 0	4½
STEEL:					
Swedish Keg	pr. ton	15 0 0	„	0 0 0	2½
„ Faggot	„	10 0 0	„	0 0 0	„
TIN:					
English, Block	p. cwt.	6 0 0	„	0 0 0	2½
„ Bar	„	6 1 0	„	0 0 0	„
Foreign, Banca	„	6 5 0	„	0 0 0	nett
„ Straits	„	5 17 0	„	0 0 0	„
TINPLATES:					
Charcoal, I.C.	pr. box	1 7 0	„	1 9 0	3
Coke, I.C.	„	1 1 0	„	1 4 0	„
LEAD:					
Pig, English	pr. ton	20 0 0	„	21 0 0	2½
„ Spanish	„	19 10 0	„	19 15 0	„
Common Sheet	„	21 0 0		0 0 0	„
Tea „ (Wimshurst's Patent) A special disct.	„	26 0 0	„	0 0 0	„
SPELTER:					
On the spot	„	17 10 0	„	18 0 0	nett
For arrival	„	17 10 0	„	17 15 0	„
ZINC:					
English Sheet	„	23 0 0	„	0 0 0	4
QUICKSILVER	pr. btl.	7 0 0	„	0 0 0	3

JAMES LAURIE, Metal Broker.
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 6, 1862.

DISTINGUISHED MEN OF SCIENCE.

PERHAPS no class of men have deserved more of their country and of mankind than the great inventors and discoverers in astronomy, chemistry, engineering, and other departments of science; yet very little is known of many of them in proportion to the acknowledged good which has resulted from their labours. We possess works of art commemorating the achievements of heroes in the field, and of statesmen in parliament, but until now no work of any magnitude has ever been executed in honour of our men whose doings have laid the foundation of our commercial prosperity. We are, however, able to state that this can no longer be said, as Mr. Walker, of 64 Margaret-street, Cavendish-square, has, after an extended period of labour, produced an engraving which must remain an enduring record of our greatest era in science—the early part of the present century. At that epoch of time, steam, under the hands of Watt, Symington, and Trevithic, was commencing its marvellous career; astronomy and chemistry began to reveal their long-hidden secrets; while the discovery of vaccination, by Jenner, had already rescued thousands from death to enjoy the blessings left as a legacy by many a silent worker in science.

The scene of Mr. Walker's picture is laid in the upper library of the Royal Institution, which was founded in 1800, for the purpose of promoting the application of science to practical uses. Here fifty-one illustrious men, living in 1807-8, are represented, assembled in three groups. The centre one contains James Watt, demonstrating to his friends—Rennie, Telford, Mylne, Jessop, Chapman, Murdock, Romford, Huddart, Boulton, Brunel, Bentham, and Maudslay—the advantages of his improved steam engine; at the opposite side of a table, Dalton and Cavendish are seated, surrounded by Davy, Wollaston, Hervey, and Smith, "the "father of English geology;" the group on the right, depicts Crompton, inventor of the spinning-mule; Tennant, the well-known chemist and bleacher, of Glasgow; Cartwright, inventor of the power-loom; and Ronalds, the first to prove the practicability of passing an electric message through a long distance. These are represented as listening to Earl Stanhope, who is supposed to be describing his printing-press and process of stereotype printing. A little behind are Bryan Donkin; Troughton, the optician; Miller, of Dalswinton, and Symington, the inventors of the first practical steam-boat; and lastly, speaking to Trevithic is Joseph Bramah, of whom there is, unfortunately, no portrait extant, he is therefore placed with his back turned. The group on the left is joined by Sir Wm. Herschel, Maskelyne, and Dr. Jenner, seated, and surrounded by Sir Joseph Banks, Davies Gilbert, Brown, the botanist, Dr. Thomas Young, celebrated for his universal attainments, Dolland, Playfair, Sir John Leslie, Frodsham, and Francis Baily. A picture of the kind we have just described necessarily depends for its value upon the accuracy of the portraits represented; and in this respect Mr. Walker has evidently spent much time and labour. The relatives have, we believe, in every possible case been consulted, while considerable assistance has also been afforded by Dr. William Sharpey, Secretary of the Royal Society, and Mr. Bennet Woodcroft, Superintendent of Specifications at the Patent Office. Through the kindness of these two gentlemen, Mr. Walker has been able to obtain access to the valuable collection of portraits in the large lecture-room of the Royal Society, and to obtain copies from many unique originals in Mr. Woodcroft's gallery of portraits at the South Kensington Museum. In regard to the general grouping and effect of the picture, we may fairly state that we have never seen so large a body of men arranged in a group, where it is necessary that all should, in a measure, present their faces turned towards the spectator, so free from that stiffness which is the general fault of works of this class. For this, great praise is due to John Gilbert, by whom the original picture (drawn by J. F. Skill and W. Walker) was designed. The engraving has been executed by W. Walker and George Tobel; while in order to render the work complete a series of memoirs have been drawn up by Mr. W. Walker, junr., and furnished with a short introduction by Mr. Robert Hunt, F.R.S., keeper of the Mining Records.

We can only now say of the book that most of the memoirs are necessarily very brief; one, that of Trevithic, contains the most information yet published regarding that eminent engineer. Both the engraving and the book are published by Messrs. Walker, 64 Margaret-street, Cavendish-square. The book can also be obtained at Messrs. Spon's, of Bucklersbury. The two together form a fitting record of the most brilliant era in science which the world has yet witnessed.

OUR HARBOUR DEFENCES.

WITH the Defence Commissioners' Report on the Spithead Forts before us, we have some hope of making the truth on that important question so apparent as to leave no room for doubt. A fair examination of the facts, suppositions, and arguments adduced by the Commissioners will, we think, prove that their conclusions contradict their premises and their theories. We are sorry to observe a disposition to make this a party question. Ministers display a nervous irritability, indicating fear of defeat. Opposition organs are too ready to give a political significance to the controversy. There is too much reason to believe that the majority of the members of the Defence Commission entered upon the new inquiry with their minds made up to maintain their first opinion, or, at least, so prejudiced as to be blind to the true bearing of the recent naval events in America and experiments at home. The *Times* has done its best to support the conclusions of the Report, which are suspiciously identical with the views of Government. Day after day that journal weaves a web of sophistry —misrepresents the events and experiments alluded to—or puts wrong constructions upon them, with the evident purpose of aiding Ministers in the coming struggle. The incidents of the naval engagements on the other side of the Atlantic are distorted with apparently no other design than to mystify the public and mislead members with reference to the nature and bearing of the facts which constitute the evidence of the case.

We are out of the sphere of party influences. On technical matters which are, more or less, of a mechanical or engineering character, we confess to the ambition of assisting that portion of the public, which takes an interest in subjects of that kind, to appreciate them correctly and come to a right conclusion on their practical application. In this case we have only in view the prevention of useless expenditure, and the adoption of the best system of national defences.

We will proceed on the plan of the article on "the Mississipi and Spithead Forts" in our last number, by enumerating the facts relied upon by the Commissioners and the *Times* in support of the recommendation to construct the Spithead Forts.

1. The Mississipi forts are advanced defences, seventy miles below New Orleans, and in their position and object analagous to the proposed Spithead Forts.

2. The batteries on the James River, only seven miles below Richmond, are not advanced defences or outer works. They are internal river defences, of the same description as the batteries which command the entrance to Portsmouth harbour.

3. The James River is only 200 yards wide at the point where the Confederate batteries are erected, and at this point there is a bend in the stream, which obliges an enemy's vessels, as they approach the defences, to come and continue for some time within point blank range, and exposed to a raking and cross fire of guns on both sides of the river.

4. The defences are of the most formidable character, consisting not simply of a fort, but of several batteries, armed with the heaviest ordnance. The fort is on a bluff, at an elevation of 200 feet, and the banks of the river are studded with rifle pits, from which the artillerymen of the Federal ships are admitted to have suffered much annoyance.

5. The Federal flotilla, with the exception of three small iron-clad steamers, whose fire was ineffective, was composed of wooden vessels.

6. These iron-clad steamers, although exposed to the Confederate fire four hours, suffered but trifling damage, and that is to be attributed to the exceptional character of a plunging fire from a great elevation, which penetrated the slightly-protected decks of the Federal vessels.

7. The river where the batteries stand is shallow, so that the attacking vessels were of small tonnage, with an armament greatly inferior to that of the batteries.

8. The old smooth bore 68-pounder is the most powerful piece of ordnance in existence, with the exception of the one 156-pounder Armstrong at Shoeburyness, which has a flaw, and cannot therefore be confidently relied upon.

9. The 156-pounder Armstrong is not yet rifled to carry a 300 lb. bolt, and the projected 300-pounder smooth bore is not made; the anticipated effects of any projectile exceeding 150 lbs. are, therefore, purely hypothetical.

10. The statement that the platform of a land fort can be adapted to train and fight a gun of extraordinary weight and power, which could not be mounted on the platform of a floating-battery, is an assumption not founded on practice or sound theory, and is in opposition to the experience derived from the firing of heavy guns from boats in actual service, which on several occasions has proved that the effect of recoil is much neutralized by the elastic resistance of the water on which the vessel floats.

11. No projectile, including the 150-pounder Armstrong, fired with a service charge, has penetrated through the Warrior section target.

12. The damaging effect produced by heavy missiles on other targets is attributable to the defects of the structures, and not the force of the projectiles.

13. The supposed effects of such heavy projectiles as 300 or 600-pounders, at long ranges, are purely theoretical; and if guns to carry shot of those weights can be made, which is problematical, there may be disturbing causes in practice which would destroy the theory. All our experience of the effects of ordnance exceeding those of 68-pounders is confined to one 150-pounder smooth-bore, at 200 yards range

These are the facts on which the Commissioners have formed, and the *Times* supports, their conclusions. These facts have brought us, as we think they must every impartial person who will take the trouble to understand and apply them to the Spithead controversy, to conclusions diametrically opposed to those of the report, and in our opinion they prove that it would be a great mistake to persist in the intention to construct the forts. We are not going to support our views by lengthy arguments; we shall simply apply the facts to the case.

Fort Darling and the batteries on the James River, only seven miles from Richmond, are relatively in the same position as batteries would be for the defence of London if erected along the reaches of the Thames at Woolwich, Blackwall, and Greenwich. There is nothing analagous in internal river defences of this kind to detached advanced forts at the entrance of a sea-way two hundred yards wide; therefore the repulse of the Federal flotilla has no bearing on the Spithead Forts question. But the Mississipi affair is a case in point, and proves, as we showed last week, that advanced forts only one thousand yards apart could not prevent the passage of wooden gun and mortar-boats; much less, then, could detached forts two thousand yards apart prevent the passage of a powerful fleet of iron-clad men-of-war. The obstructions which are possible in a narrow stream and shallow waters by sinking vessels and stones and driving piles into the bed of the river, could not be formed in a tidal sea-way of great width, so that it is unfair to draw any conclusions from the former case as applicable to the latter. The position at Fort Darling is well chosen to bar the river a few miles below Richmond, but it has nothing to do with the question of advanced forts. Nothing has occurred in any of the incidents in America, referred to by the Commissioners, to lessen the efficiency of iron-clad vessels opposed to land batteries, as established by the exploits of the Merrimac and Monitor in Hampton Roads. The Manassas, and the floating battery in the Mississipi combat, were structures of so frail a nature, that they sunk under the broadside of a wooden vessel. It is absurd to class them as effectively armour-plated men-of-war. The Monitor, Galena, and Nangatuck, which are small vessels protected with iron plates, although it is admitted their armour is defective, have played their part well, and, by the results in every action in which they have been engaged, have confirmed the value of iron-armour against guns. The invulnerable sides of the Monitor kept the Merrimac at bay. The Galena had an affair with land batteries, which she silenced, and suffered no injury herself; and before Fort Darling the three little iron monsters for more than four hours were under the fire of the most formidable artillery, and received no damage worth speaking of. The officer in command of the Federal flotilla, writes, "The action was "gallantly fought against great odds. It was "impossible to reduce such works without the "aid of a land force." The Galena fought at 600 yards range, and only drew off when her ammunition was expended. The injury she sustained was from the plunging fire of an elevated battery, which pierced her decks. The Monitor, unable to elevate her guns sufficiently, could not use them, but she was a long time exposed to the enemy's fire, which made no impression on her armour beyond slight indentations in the iron. The Nangatuck was uninjured.

A mistake which runs through the Report of the Commissioners, and pervades the articles of the *Times*, is, dealing with the proposed Spithead Forts on the assumption that they would be attacked by an invading enemy, and have to defend themselves in a combat with iron-clad vessels. Now that is altogether a reversal of the case as it really stands. The question is not—"Shall "forts be erected at Spithead to resist an "attack which may be made upon them by an "enemy's vessels?" but the question is—"Can fixed forts at Spithead be of any avail to "prevent the passage of armour-plated ships." The report takes the former view, and expends an immense amount of hypothetical argument on points which are foreign to the latter, which is the real question.

We must reiterate the unanswerable argument in favour of floating batteries, which we have so often maintained—"That land forts "cannot advance to meet the attacking force—"nor keep close to or follow it up; but floating batteries can do all these things." The enemy's ships once past the range of the forts, the latter are useless. The proposal to interpose obstructions for the purpose of keeping the enemy under the guns of the fort proves their inefficiency. It is an admission that forts can only have the chance of firing a few guns with effect at fast war-ships, steaming rapidly past the range of their batteries, and, therefore, the proposed means of obstruction are devised. But if these aids are of use to shore batteries, which we do not deny, they will be infinitely more available in support of floating batteries. The latter can bring their fire to bear at 200 to 300 yards less by taking a station that distance from the shore, for it must always be borne in mind that the object of batteries at Spithead, whether on land or afloat, is not to wait to be attacked by, but to attack an enemy, and prevent his passage up to Portsmouth harbour. Fixed forts cannot do this at night or in the grey of the morning, when the hostile vessels would be invisible at a distance, but floating batteries laid close to each other across the seaway can. Another mistake of the Commissioners is not to draw the distinction between iron-clad batteries and iron-clad fighting ships. Everybody is agreed that we must have the latter to support the former, whether the batteries be on land or afloat, and yet the Commissioners insist upon the necessity of the supporting vessels, and waste their logic in doing so, as if it were a disputed point.

But the real question—and, in fact, the whole question—is, shall the main advanced defences to guard the channel which leads into Portsmouth Harbour be fixed on opposite shores, 2,000 yards from each other, or shall they be floating batteries? Before that question can be answered, we have to determine what is the kind of floating structure which can best fulfil the required duties; and until that is settled, it is idle to prejudge the question, as the Commissioners have done, and decide that forts are preferable.

We have no hesitation in expressing our belief that the appliances of art, and science, and practical mechanical skill, which exist in this country, if appealed to by Government, will produce iron-mailed floating batteries of so formidable a character, for attack or defence, covered with armour impenetrable to the fire of any guns which sea-going ships can carry, and provided with so powerful an armament, that, possessing the means of locomotion—although not at a high speed, which, in this case, is not requisite—no land fort could surpass them in destructive power, or be compared to them in efficiency, because floating batteries can choose their position, and attack the invading force at short range—two immense advantages, neither of which forts can command.

Here, for the present, we leave this question, but we shall return to it, recommending our legislators to call upon Government to ascertain whether armour-plated batteries, with moderate propelling power, could not be constructed of so powerful and efficient a character for the service they would have to perform, as to be superior to forts as the advanced defences of harbours and rivers.

[In the *Times* of yesterday there is a sensible remark on the frequent failures of the Americans in their attempts to construct rifled ordnance of large calibre. From the great gun of the frigate Princeton, which burst and killed the Secretary for War, to the Dahlgreen and Parrott guns, one of the last of which, on board the Nangatuck, in bursting, killed thirteen men, these attempts have proved unsuccessful. The rifled 100-pounder Armstrong is not a success. The gunners, it is said, work it in fear and trembling, and its effects at battering range are inferior to the smooth 68-pounder. To form theories of the probable effect of 300 and 600-pounder rifled guns, the possible existence of which is in the remote future, and to advance these theories as arguments in support of an enormous expenditure for the construction of fixed forts, savours of the wild dreams of the philosophers of Laputa. The *Times* notices one American statement that the Monitor received only three shots before Fort Darling; but it passes in silence the official despatch, which admits she was hit eighteen times, but suffered no damage sufficient to disable her.]

THE INTERNATIONAL EXHIBITION.

THE WESTERN ANNEX.

No. IV.

It is now possible to view, without inconvenience, except that arising from the heat of the atmosphere and the odour of oil and tallow, the various mechanical specimens of British ingenuity in the Western Annex. A very beautiful combination of science and mechanics as applied to the art of engraving is to be seen in the Electrograph engraving machine of Mr. Henry Garside, of Conpland-street, Manchester. This is intended for the engraving of copper cylinders used in calico printing. The distinctive feature of this apparatus, apart from its mechanical arrangement, consists in the application of voltaic electricity in communicating movement to important and delicate portions of the machine. The cylinder to be engraved is first coated with a thin film of varnish sufficiently resistant to the continuous action of the strongest acids. The required number of copies of the original design are then traced on the cylinder by means of a series of diamond points arranged on the machine, in a line parallel to the cylinder. The metallic surface of the latter thus becomes exposed at the parts required to be engraved. A bath of nitric or some other potent acid is afterwards used to deepen the exposed portions to the extent required, and thus the operation is completed. The diamond points are all in connection with as many small magnets, and these are so arranged that intermittent voltaic currents are established in unison with the original design. The results are that the diamonds are withdrawn or advanced at the proper moment, and the tracery forms an exact counterpart of the copy. There are, also, adjustments, which enable the operator to enlarge or diminish at will the size of the patterns to be engraved. It is unquestionable that this exquisitely ingenious contrivance will interfere materially with the system of hand-engraving as pursued heretofore, but, as usual in such cases, the benefits accruing to the public will be marvel-

Digitized by Google

lously enhanced. It is not long since we had occasion to speak of a machine intended for engraving upon steel, and cutting cameos. It is to be regretted that this contrivance cannot be placed in the Exhibition beside the electrograph engraver above named. Together these machines would point out the only course which, in future, is likely to be open to copper and steel engravers, namely, the more perfect study of designing and modelling.

As regards the steel-engraving machine, work done by which we have seen and intensely admired, we have no hesitation in saying that it is destined to revolutionize die-engraving and gem-cutting. It appears to delight—if we may so speak of an inanimate object—in the performance of the minutest elaboration of workmanship. The first process in connection with steel-engraving by machinery is to form, in wax, a model of the device to be copied. Of this an electrotype is taken with great care, and from it, as a guide, the machine proceeds to its task. As in the case of Garside's electrograph, the size of the engraving may be varied from that of the model or copy, without difficulty. Voltaic agencies are not, however, used in the actual engraving of the device—mechanical means compassing all that is required in this respect.

It is probable that when a new Patent Law shall exist which will deal more fairly with clever inventors than the old ones have done, this admirable discovery will see the light of day. As it is, the inventor, like many others of his class, prefers keeping the precise mode in which his machine works, a secret.

Pursuing the subject of automatic machinery yet further, and we come to Thompson's patent universal joiner. This is the invention of Robert Henry Thompson, of H. M. Dockyard, Woolwich. It is an ingenious apparatus, capable of being worked by hand or by steam-power, and applicable to a variety of purposes, as its name implies, connected with joinery. The copying principle is here again employed, and thus diversity in the form of work to be produced is no barrier to its action. It may be used for any description of joiners' work, including gothic heads, elliptic and all other curves, mouldings of whatever form, the strings of stairs, with treads, risers, and handrails, together with plain or ornamental work for cabinet or coachwork.

With some modifications, and, of course, with a change of cutting tools, the "universal "joiner" may be converted into a general mason, for it does not object, under such circumstances, to deal with stone.

Mr. Thompson also exhibits a "patent tree- "feller," and a "patent sawing-machine," and these are the natural feeders to the joiner. They perform the rough work, indeed, and the joiner the smooth.

We have before spoken eulogistically of the sawing, planing, turning, and other machines of Worssam and Co., of Chelsea, and it would be unjust to omit equally honourable mention of Powis, James, and Co., of the Victoria Works, Blackfriars-road, who figure in similar kinds of wood-working machinery. The contractors' and builders' combined machine for planing, moulding, and edging planks or timbers on all four sides at one time, is a remarkable specimen of an economic contrivance for working on wood. So also is what they felicitously and accurately designate their "*multum in parvo*," or general joiner. This machine will saw, plough, groove, rebate, thickness, bore, cross-cut, and strike mouldings. In its presence, therefore, the carpenter must hide his diminished head. Many other machines for the conversion of wood into the thousand forms required for cabinet operations, carpentry, pattern-making, &c., are shown by this firm, but space warns us that other mechanical wonders must pass unnoticed if we linger too long among them.

In a well-arranged "stand," as it may be termed, William Muir and Co., of the Britannia Works, Manchester, exhibit a considerable number and variety of engineers' tools. These consist mainly of lathes, shaping and slotting machines, radial drilling machines, screwing tools, &c., &c. In all of these is displayed considerable ingenuity, and, in fact, peculiar adaptation of means to ends. Indeed, as regards small tools for engineering shops, Muir and Co. hold a very reputable position in the mechanical show. Simplicity and universality of application appears to be the motto of this firm. Their patent grindstone apparatus is not unworthy of especial remark, and this may be the more conscientiously made from the fact that we have seen it frequently in successful operation.

It is not necessary to tell the generality of the readers of this journal, of the advantage which attends the existence in engine factories, of ready means for sharpening tools for cutting iron, or grinding those for cutting wood. The first point is to have stones of the proper grit, and the second, to keep them in good order. This latter is frequently a matter of difficulty, from the inattention of those who use them. Mr. Muir's grindstones are, so to speak, self-adjusting and self-repairing. He places two stones in one trough, and these work edge to edge. They are regulated by a right and left-hand screw, and, by means of a cam, a slight lateral motion is given to one of them. The effect of this is to keep the grinding surfaces of both constantly "true," however unfairly they may be used by the workmen. The disagreeable and, from the dispersion of particles of sharp-cutting dust, very objectionable process of turning down grindstones, is completely obviated in this instance.

We have said on a previous occasion that with steam hammers the Western Annex is well supplied. The name of Nasmyth is, of course, inseparably connected with this valuable implement for the forge; and Nasmyth and Co. are represented extensively at South Kensington. Many modifications of the steam hammer have been made by different makers, with a view to overcoming some of the defects existing, or said to exist, in its original construction. Of these modifications, Robert Morrison and Co., Ouse Burn Engine Works, Newcastle-upon-Tyne, display a rather remarkable example. This is called the "Double-Acting Steam Forge "Hammer." The main point of improvement in this apparatus is comprised in the fact that the hammer bar and the piston are forged solid together. In other cases, where a different mode of attachment was adopted, the piston and piston-rod have sometimes, from the violence of repeated strokes, parted company. In this instance such a catastrophe, we need not say, is next to impossible. The steam cylinder is firmly bolted to the single frame which supports the whole. This frame also contains the steam-chest, steam-passages, and the steam and exhaust pipes. The hammer-bar is furnished at its lower end with a claw for holding in the different faces, or dies required for various kinds of work.

The piston is simple in its construction, and two small steel rings fitting into grooves on its circumference make it steam-tight. Above the piston the bar is planed flat on one side, a corresponding flat being left in the cylinder cover. This arrangement has the effect of keeping the bar and the hammer face constantly in the same relative position to the anvil. On the top of the hammer-bar there is a small roller which works in the slot of a lever. The lever, with the aid of a pair of links and a slide-rod, gives motion to an ordinary box slide which admits steam alternately above and below the piston.

These arrangements comprise the distinctive characteristics of Morrison's hammer; but there are other points of detail, and especially with respect to the control exercised over it by the attendant, which are worthy the consideration of those who require so formidable a forge assistant.

The Kirkstall Forge Company, of Leeds, and 35 Parliament-street, London, are also exhibitors of steam hammers, and rapidity of action is one of the principal qualifications for which they claim attention to their implements. No doubt in many cases this point is a momentous one, because the completion of a forging at one heat is very frequently a desideratum. The machines shown are massive and well constructed.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE.'

LETTER XIV.

THE PENETRATING AND CRUSHING EFFECTS OF PROJECTILES.

THERE is no branch of the profound and complicated question of iron against artillery of more importance than that which relates to the effect of projectiles on an armour-plated structure. I am not aware of the existence of any precise theory on that point. Opinions, no doubt, are entertained by engineers to the effect that the greater the mass of solid iron opposed to cannon balls, the greater the force of resistance. Guided by this prevalent idea, the officials who are responsible for the construction of our naval defences, and who bow to the dictum of professional authority have adopted the rule of enormous dimensions for armour plates. Those of the Warrior are 15 feet in length, 40 inches in width, and 4½ inches in thickness. The plates of the Northumberland class are to be of greater length, and 5 to 5½ inches thick. It is especially in thickness that the official constructors believe the greatest security is to be found, and impressed with that belief, they give encouragement to manufacturers to surpass each other, and it is now seriously proposed by a firm to supply 8-inch plates. As to length, there seems to be no limit. The enterprising proprietors of the Atlas Works at Sheffield, would undertake AT A PRICE to roll plates 40 feet in length. The iron court at the back of the Eastern Annexe of the International Exhibition contains specimens, which for perfection of manufacture, and colossal size, are wonders of the world. These results prove that our iron works can respond to any demands on their capabilities of production, however extravagant; but they do not prove that immensity of dimensions in single plates is the right rule. Still the unanimity of professional opinion in that direction is remarkable, and it would deter me from venturing to controvert it, if the plans of armour-plating of some of the "great authorities," relied upon by the Secretary to the Admiralty, had not broken down when they came to be tested under the fire of artillery.

The last of the targets tried at Shoeburyness was that of Mr. Scott Russell's, one of these "great authorities," and one of the staunchest advocates of masses of solid iron to resist projectiles. This trial was reported in your journal and in the *Times*, and Mr. Russell has challenged all comers to a discussion on the merits or demerits of his system. In a letter to the *Times*, he frankly admits his "bias" in favour of his own plan. He loves his mutilated child. He contends that his target is less damaged by the fire of heavy guns than any other which has been tried, and is of opinion that in its present state it will resist any further attacks of projectiles better than the Warrior section. As I differ *in toto* from this estimate of the results of the experiments and the condition of the target after their conclusion, I am at liberty to discuss these points freely on public grounds. I shall do so the more readily, because in a previous letter I pointed out the defects of his plan, and correctly predicted the results of the coming trial; and also because I find in these results a practical illustration of a theory which it is my intention to propound in this letter.

In the Magazine of March the 7th, which contained a diagram of Mr. Scott Russell's plan, after pointing out its similarity in principle to Mr. Plum's, I observed:—"In both cases the plates, when the work is finished, are held at their edges by dovetailed ribs between the plates. The only difference is, that in one case (Mr. Plum's) these ribs are manufactured complete, and ready for use, before they are fastened to the ship; and in the other (Mr. Scott Russell's) the heads of the dovetails are formed out of angle, or T irons, of which the projecting ends are hammered down after they are fixed. No amount of hammering at the edges, however carefully executed, will fix the plates firmly to their bearings and prevent vibration, or even oscillation, which is a greater evil.

"The success of any kind of frame fastening to the edges of the plates, however it may be carried out, is problematical. This edge fastening, which holds the plate like a slate in its frame, offers no security against vibration, and is liable to be ripped up, and stripped off the plate. The rivets, or bolts which fasten the ribs, and are liable to receive the full shock of every concussion, may be broken off."

Not to repeat what is contained in your report of last week, I refer to it to prove that the disastrous results I anticipated from the vibration and oscillation, which are inseparable from a system of frame fastening, were fully realised, and precisely in the way I predicted.—"the plates cracked like panes of glass, the fastenings were broken, and stripped off."

The confident tone of the constructor of the target must surprise every one who has closely observed its present condition. Here is what he writes:—

"The great gun weighing 12 tons did on that day fire two successive shots at my target without *penetrating* the armour. It is equally true that no other armour has been able to do this.

"Of all the other kinds of shot fired at this target, no single one PENETRATED the armour.

"The one fact made prominent by your informant, that the target was penetrated in one place by a 150-pounder, is true, but the shot hit a weak place, which we all know to be weak.

"A narrow plate was selected. The shot perforated the narrow plate, as it ought to do, and gave us no information except what we knew before."

All this is word-fencing. Two 150lbs. shot from the 12-ton gun, it is said, did not "penetrate" the armour. The writer means they did not pass clean through the target. That is literally true; but the damage done was infinitely worse than it would have been if the shots had penetrated the armour by passing through and through the structure. Instead of doing so, they fractured the armour plate, the backing, and the skin plate, split the frame fastenings to pieces, tore away rows of rivets, and seriously damaged the structure of the ship. A hole might be plugged, but rugged fractures, such as those caused in this target, could not be repaired in action; and if between wind and water, would be fatal. Mr. Scott Russell is mistaken in asserting that no other armour resisted the penetration of the Armstrong 150-pounders. Three of these shots, fired with 50lbs. of powder, which is the same charge as that used against his target, passed through the 4½-inch plate, but encountered so much obstruction from the teak backing, that they did not penetrate or even fracture the skin plate, and the ship's structure suffered no damage whatsoever. Sir John Hay said in the House what was perfectly true, that a man standing close behind the place struck by the shot would have received no injury. This is more than can be said for Mr. Scott Russell's target. A naval officer, who knows something of service, said this system was admirable to supply the enemy with a volley of langridge, the skin and backing plates being shattered into small fragments, which would have told fearfully on a crew inside a ship protected on this plan. The two 150-pounders which penetrated and passed through the Warrior section, were fired with 60lbs. and 70lbs. of powder, and are, therefore, not to be compared with the shot fired at Mr. Russell's target. But there was one 150-pounder fired with only a 50lbs. charge, which did penetrate, with a terrible crash and destructive effect, through his target. He says it struck at a "weak place;" but there is no more ground for that assertion than his former one, in which I have shown he was mistaken, except that *every place* of his system is *weak*. The reason why the two shots first referred to did not penetrate through the armour is clearly explained in your report. At Mr. Russell's special request they were fired at the bottom plate, so close to the foundation of the target, that his system was materially fortified by the iron girder which supports the target along this line, and forms a strong backing to the plate which the shots struck. All is fair in war; and Mr. Scott Russell having the first choice where he would be hit, shrewdly selected the least vulnerable place; but when the gunner's turn came, he selected not a weak place, but simply a fair place, where there was no additional support behind, which formed no part of his system. Mr. Russell comforts himself with the reflection that possibly the fact that his plates were narrower than 3 feet accounts for the break down of his system; but he takes care not to point out another prominent fact which gave his target an immense advantage over all others which have been tried. It has 8½ inches of solid iron in thickness all over. The Warrior has 5½ inches of iron and 18 inches of teak, equivalent to 2 inches of iron, making 7½ inches. The Fairbairn has 6½ inches; and the Samuda, at the weakest parts, the panels only 6 inches. So that if mass of iron, as the authorities contend, is of any value, the Scott Russell system ought to have resisted better than all the others, and yet it suffered the greatest injury. If a jury sat upon the targets, that would be their verdict.

The conclusion to be drawn from these results and from others of a similar nature is, in my opinion, incontrovertible. *The penetrating and the crushing effects of projectiles* are, when resisted by iron plates, wholly independent of each other, or it may be more proper to say that to resist those effects they should be considered separately, and not confounded with each other.

The term penetrating force, and penetrating effect, are used with great laxity. They have been so used in reports of experiments to such an extent that their true meaning has been lost sight of. By penetrating force or effect, as applied to an iron projectile striking an iron plate, I understand the power of the shot to pass through or bury itself in the material of the plate, supposing the plate to be held firmly in its place without motion or vibration, and without any yielding of the back support on which it bears. To exemplify my meaning I will refer to the familiar example of a punching machine punching rivet holes in a plate. The effect produced in that case is the penetrating effect of iron, or rather of steel on iron. Now, in this operation there is a law known to every boiler maker. No force will drive a punch through a plate unless it be of greater diameter than the thickness of the plate. A one inch steel punch will not go through a one inch iron plate; it will go through a ¾ or perhaps a ⅝ inch plate; but if the punch, instead of being of steel, were of iron, it probably could not be driven through a ½ inch plate. Experiments have been made which invariably have resulted in the punch or the machinery being broken if the former has been less in diameter than the thickness of the plate. Here, then, we have a law which applies to projectiles in the shape of cannon shot, which are punches propelled with the explosive force of gunpowder. Pursuing the analogy of the punching process, if a plate were placed under a punching machine without a die or a solid support at the back of the place struck, the punch would not penetrate the plate. It might, if there were no support behind the plate, or if the plate were placed on a plank of wood, bulge and perhaps crack the plate, but it would not pass through it. I think, then, the nature and extent of the penetrating force of iron projectiles against iron plates is clearly defined by the punching process, and the truth of this definition is confirmed by numerous results of target experiments, showing that where the backing was hard, and rigid, and did not give way, the amount of penetration of the shot into the iron was extremely limited. On another occasion I will adduce examples in corroboration of that fact, but I have already exceeded the space you can allow to one of my letters. I have said enough to make the nature of my theory apparent. I think it has not attracted the attention of scientific men, or they would before now have dealt with it more ably than I am able to do, and I think they would have succeeded in deterring the authorities from incurring an extravagant and perhaps useless expenditure, in paying enormous prices for monster plates, the use of which I regard as a mistaken attempt to unite in the armour plate itself the power of resistance to the penetrating and crushing effects. These effects I will endeavour to show may, with success, be resisted separately, by forming a structure independent of the armour plates, which shall resist the crushing force, and using the armour plates to stop or break up shot, as a boiler plate of greater thickness than the diameter of the punch would, if placed on a solid bearing, break the punch or the machine which drives it.

A CIVILIAN.

INTERNATIONAL EXHIBITION.

THE AMERICAN COURT.

No. II.

We resume our notice of this portion of the Exhibition in a desultory kind of way. Indeed, no other course is permitted to us, as the arrangement of the Court is itself desultory. No kind of classification has been made, and we believe at one time it was doubtful whether an American Court would be opened at all. Even now we may say that the arts and manufactures of the United States are unrepresented. The collection we have in the south-eastern angle of the building is not here through the patronage or encouragement of the United States Government, which has other work on hand. It was through the enterprise and creditable ambition of a few private individuals, who were determined to show, at their own risk and on their own responsibility, that there is inventive skill in America, which is not afraid to measure itself against that of Europe in the same direction. Not a single Southern State is represented. This may be on account of the blockade, but it is said that had there been no blockade at all, the South, though she might have shown well in natural productions, could have made no figure in manufactures or mechanical inventions. Only two or three patents have been taken out in the Southern States for many years, and these in the Carolinas. The State of New York, and the Northern States generally, have been the fertile source of all the inventions which have been patented since the Exhibition of 1851.

The United States Court is represented by Mr. Holmes, and his son-in-law, Mr. Taylor, an eminent engineer. It is due to the energies and sacrifices of these gentlemen that America is represented at all, and the things which their public spirit has brought together indicate the actively practical mind of their countrymen. There are nearly a hundred articles in the various classes exhibited, and most of them have the merit of novelty, as well as utility.

As one might expect, sewing machines are well represented—those of the lock-stitch, the chain-stitch, and the shuttle machine, with all their peculiarities. They are successfully exhibited, and form a great attraction. The rapidity and neatness with which these machines execute a variety of needlework is amazing to those who know only of the common needle as the grand making and mending instrument in the household, and the symbol of the most distressing drudgery. As we intend to devote a special paper to these machines, we pass them by at present. In class 1, Mr. Feuchtwanger exhibits a thousand specimens of minerals; Mr. Meads, from Lake Superior, and the New Jersey Zinc Co., specimens of zinc ores with their products, pig and bar iron, and steel. In class No. 2, Mr. F. S. Pease, of Buffalo, has a variety of mineral and animal oils for use in lubricating machinery, and as illuminating agents.

The various oils are shewn to great advantage in glass cylinders of various altitudes, and appear to attract great attention. We have coal oil for lubrication; oil from tar for machinery; also signal oil, that is, oil which may be used on locomotives, on the foremast of a ship, or on a railway signal; we have oil so limpid that it adapts itself excellently to the rapid motions of the sewing machinery, as it never gets gummy. There is a sample of oil from compressed lard of amazing transparency. The latter goes by the name of winter oil, as at 3° under freezing point it never coagulates, and is admirably adapted for the lamp in cold climates on that account. The engine and machinery oil is equal to sperm, and much cheaper: it stands a greater degree of heat and a greater degree of cold than sperm oil, and does not consume so fast. Mr. Pease has samples of petroleum in the crude and refined state, which cannot be exhibited in the building on account of the fire insurance policy. There is, further, an oil shown called "armour oil," which is intended especially for gun-locks, and in which our volunteers may perhaps feel an interest on account of their Enfields and Whitworths.

By the side of these oils are exhibited hops, seeds, wheat, beans, peas, buckwheat, and samples of starch and flour manufactured from Indian corn or maize, of which there are shewn a number of specimens in the ear. The starch is extolled for the gloss it gives to the linen or cotton to which it is applied. The flour is remarkably white and fine. Samples are here, too, of a farinaceous article manufactured by the Glencove Starch Company, of New York, under the name of "Maizena." It is the purest preparation of the finest maize. In a short time, and without any trouble, it can be made into various forms of diet, and is a good substitute for arrowroot.

Having disposed of these odds and ends, we proceed to notice a few mechanical contrivances, and, first, near the south east entrance one is attracted by a cork-cutting machine invented and patented by Mr. Conroy, of Boston, there is one machine which cuts the cork into paralle-pipedons, and then into smaller figures of the same kind according to the length of bung or cork required. These smaller pieces are brought in contact with a knife mounted on a circular horizontal disc. The disc is put in motion by a large wheel similar to a cutlers' wheel, and a band running over a drum in immediate connection with it; or it may be worked by steam power. This disc, by means of gearing, traverses a platform from right to left, and *vice versa*, by which arrangement a cork is no sooner cut on one side than a cork is cut on the other. The square body to be transformed into a rounded is placed in a groove; the gearing seizes it in the manner of a piece of wood in a turning lathe, by its extremities, advances it to the edge of the circular knife, and in an instant the rough block of cork appears a shaped article wherewith to stop a beer barrel, a bottle of champagne, or a medicine phial. The ease with which this machine does its work is surprising. A clever cork-cutter, working by the hand, can turn out, on the average, eight gross of corks a day. By this machine can be made fourteen gross of corks per hour. In a day of ten hours, therefore, two men can produce 20,160 corks or bungs, while two men by the hand in the course of the same time can turn out only 2,304. The corks can be cut in perfect cylinders, or bevelled to any angle required by slightly elevating the horizontal disc. The machinery is very simple, and ingenious through its simplicity.

A bolt is shown in one part of the Court, which has all the excellency of the rivet, with this advantage over a rivet, that when required it may be moved from its place without any trouble. It is well adapted for the framework of locomotives and railway carriages. The bolt passes through an iron frame, or through woodwork, and is secured behind by a nut. But inasmuch as a nut is liable to be unturned in the extremity of the thread of the screw-bolt by vibration, and as many railway accidents have happened from the fact of bolts having parted for the want of their retaining nuts, in the present case the nut is kept into its place by having a spring inserted into it, which adapts itself to the ratchet-work of a hollow washer. The inventors are Messrs. Lawrence and White, of Melrose, N. Y. Close to the screw-rivet bolt is a contrivance for common land carriages. A coupling iron, which accomodates itself to the oscillations, of a carriage on a rough road, without inconvenience of the horse or horses, and which, fitted on the fore axle of a four-wheeled vehicle, answers all its radical motions, without being pinned like the bolt under the axle. It is, in fact, a kind of universal joint, answering to every motion of the carriage or of the horse, and which, if adopted generally, is likely to prevent many accidents.

Scholl's life-boat is constructed on a novel principle. The model exhibited is rather a rough one. It looks like a great green porpoise, with a lid opening into his back. Look into the interior, however, through the lid, and you discover the arrangements for the accommodation of a crew and passengers—for the saved and the saviours, as the case may be. The object of the boat is to pass through a heavy surf with safety. The internal fittings of the boat are below the centre of gravity and of flotation. They are hung in the manner of a binnacle compass, that is, be the motion of the external shell or hull of the boat what it may, the persons within are always maintained in a horizontal position. Indeed, let the boat turn round and round like a spindle, which is hardly possible, its passengers are nevertheless unmoved. The steering apparatus is within, and so also all the arrangements for a screw propeller. This boat has no outer deck; indeed, as we have said, in form it resembles a porpoise in the model, and on a large scale it must be something "very like a whale."

There are four exhibitors of pianos, all of New York city or county. These instruments vie in tone, and power, and in cabinet work, with any in the other courts of the building. In power, we suspect that they will carry off the prize against all competitors. We had the opportunity, at least, of listening to a square and a grand exhibited by Steinway and Sons. The internal arrangements of these instruments are novel; the strings are not all in parallels like those in the usual pianos; on the contrary, the bass strings are placed at acute angles above the tenor and treble strings, and obtain the full advantage of the sounding board. The motions of the hammers are not impeded by this arrangement. The grand has seven octaves, and tone loud enough for a large concert room, and yet, through the mechanical arrangements of the instrument, it can be made to play as softly as if it had been intended for a sick chamber. Amidst the many musical instruments to be found throughout the building, the visitor, curious in these things, should by all means see the pianos in the American court.

INFLUENCE OF EXHIBITIONS ON INTERNATIONAL PROGRESS.

A very able paper was recently read before the Society of Arts on the International Exhibition of 1862, by Mr. William Hawes, in which it was clearly shown that the present Exhibition is much superior to its Hyde Park predecessor of 1851. We have only room for the conclusion of the paper.

"We will now proceed," says Mr. Hawes, "to inquire whether the Exhibitions of 1851, 1855, and 1862 have produced the good results anticipated from them, whether they have stimulated industry, and whether they have promoted goodwill among the great nations of the world. Many will reply at once, and consider it a perfect answer to the inquiry, that there has been more war since 1851 than there was in the 20 or 30 preceding years. This may be quite true, and yet it may not be difficult to prove that, notwithstanding the Russian and Italian wars, both hotly contested, but more speedily terminated than any previous wars begun on a similar scale, the improved tone of feeling among the nations of Europe and between their goverments, and which enabled us to hold the first International Exhibition in 1851, has been still further and more rapidly improved since that time by the influence of the French Exhibition of 1855. The very great increase in the number of foreigners who visited England in 1851 beyond those of any previous year, the annual increase since that time, is of itself evidence of great value. The correspondence, however, between the two countries affords the most certain evidence of increased intercourse. In 1851, the year of the Exhibition, the number of letters was 2 495.375. This number increased steadily, at about the rate of 4 per cent. per annum, till 1860. In 1861 the increase was nearly 25 per cent., and the total number of letters which passed between England and France was 5,438,225, an increase of nearly 120 per cent. in ten years. But, besides this, we have the acts of foreign governments, which prove that in their opinion increased facilities of intercourse with England have been and are mutually beneficial. Independent of the evidence afforded by the commercial treaty with France, we have the great fact of the abolition of passports for Englishmen by several of the most important governments in Europe, a boon of great value not only for the commercial facilities it affords, but for the confidence it exhibits in the English character. But whilst international communication is facilitated between certain European countries, and trade increased, what evidence have we that the industry of the world has been stimulated, and that we as a nation have derived benefit from these Exhibitions? In a period so short as ten years it is not so difficult to mark progress as to trace that progress to its right source. We must, then, be content to say that, coincident with our adoption of those liberal feelings which prompted the first design of an International Exhibition, and their acceptance by foreign countries, we have a steady and most decided increase of trade and intercourse between the various countries of Europe and the world. We see the distrust which was unmistakeably shown abroad in our fair and honest intentions when the invitations for co-operation were first issued in 1851, replaced by the most entire confidence in 1862, and the number of foreign exhibitors nearly doubled. We have benefited from the unrestricted comparison of the industries of both countries in the exhibitions of 1851 and 1855. Each saw that it possessed advantages in the production of certain articles of commerce and of general use; and using the knowledge so obtained, we have, by abolishing prohibitory duties, promoted those industries for which each country is best adapted, and thereby bound our commercial interests more closely and firmly together.

"Here, then, is the evidence of the general benefit derived from these accumulations of the world's industry under one roof, and open to the inspection of all—here is the evidence of the confidence this universal contribution of industry of all kinds, from all nations, inspires, increasing good-will among people who, till lately, had little accurate knowledge of each other, and still less of the actual state of their respective industries. Besides, the all but universal interchange of postal facilities, and the adoption of our system of stamps, by which postal arrangements between the various countries of Europe are much facilitated, are strong evidences of a mutual desire to encourage intercourse. No one will pretend that these changes are to be attributed entirely to the effect produced by two International Exhibitions, but they prove that the confidence each nation has in the other has been gradually strengthening and increasing, rendering restrictions on intercourse needless, to the great benefit of all.

"Surely, then, we are not wrong in assuming that the improvement which has taken place in the fiscal regulations between France and England was much promoted by the information obtained at the Exhibitions of 1851 and 1855. They caused an immense increase in our commercial intercourse—they taught us each other's industrial power—and with the specimens of our own industry and of those of foreign countries now before us we can safely say, that whilst in no former similar period has there ever been such progress as in the eleven years just passed—progress, especially, in the improved and cheaper production of everything which enters into the every-day life of the people of every nation participating in these exhibitions,—England, perhaps more than any other, has derived great advantage from them. No one who remembers the articles exhibited in 1851, in earthenware, hardware, glass, furniture, and all the innumerable comforts and necessaries of life, can doubt this beneficial movement.

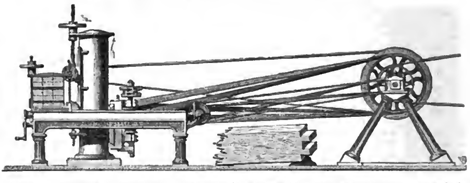
"If I am correct in these conclusions, and in this statement of the facts on which I base them, there can be no doubt that International Exhibitions do promote the industry of the world, have thereby been productive of general good, and must be beneficial to us, as well as to every nation contributing to them; and I trust, again quoting the words of his late Royal Highness, "that now the products of all quarters of the globe are placed at our disposal, we have only to choose which is the best and cheapest for our purpose, and the powers of production are entrusted to the stimulus of competition and capital."

"International Exhibitions cannot benefit any one nation exclusively. We must be satisfied that there is room for the success of all, and that the country which displays the most energy, skill, and judgment will, in the end, derive the greatest benefit from them.

"Thus I have endeavoured, feebly I fear, to record what has been accomplished during the past eleven years, as shown by the Exhibition now before us. But it is impossible to conclude this review of the progress of industry since 1851, without recollecting that during this period, in which so much has been done—in which so much talent, science, and industry have been devoted to the art, manufactures, and commerce of the world, there have been two European wars begun and ended; we have quelled a mutiny on a most gigantic scale, threatening our largest, richest, and most important possessions in the East; there has been a war with China; wars with the aborigines in our colonies—some begun and finished—but one still raging: our trade with America, by its internal dissensions, has been almost destroyed, and our most important industry at home thereby paralyzed.

"Every important State in Europe, as well as the great Republic across the Atlantic, has been getting year by year deeper into debt, to the extent, in the aggregate, of £500,000,000, spending this immense sum either to coerce their subjects, or to check the progress of independence, or out of pure rivalry and jealousy of one another's power, thereby crippling the industrial resources of mankind. If, while industry has been so heavily taxed, and the labour of so many thousands withdrawn from it, it has advanced more rapidly than was ever known before in a like period, have we not a fair right to attribute a portion of this movement, and not a small one—to the effect produced commercially, industrially, and socially by the two International Exhibitions already held, and the anticipation of and preparation for that now before us? And if such results have been realised during the past ten years, what may we not expect if it please Providence to allow nations to learn wisdom by experience? Wisdom to avert war by the study of the records of death, disease, and crippled industry which follow in its train; wisdom by the study of the arts of peace, and the happiness and contentment, the political and social order it produces; and wisdom to study the results, equally clearly marked by every step taken in the direction of free trade, of removing shackles from industry, and of reliance upon the loyalty of a contented and industrious people—then, indeed, we may expect greater results in the next ten years than those, great as they undoubtedly are, of the past decennial period. Greater or even equal waste of industrial resources in a similar period by the governments of the world it is hardly possible to conceive. It is, then, a proud position for this Society, having originated International Exhibitions, to be able to point to the Exhibition of 1862 as fully justifying a course of action persistently pursued for many years; and I trust the Council will continue to be guided by the principles it has hitherto adopted, remembering, in all it undertakes, the wisdom and prudence, yet promptness and liberality, which distinguished our late illustrious President, and then I fear not that an increasingly useful and honourable career is yet before it, and that at some future but not too distant period, the Society will again become the promoters of another International Exhibition."

POWIS, JAMES, AND Co.'s DOUBLE TENON CUTTING MACHINE.



DOUBLE TENON CUTTING MACHINE.

Messrs. Powis, James, & Co., exhibit in class seven, western annex, this machine, which will cut double or single tenons, and is made expressly for doing the heavy framing for railway carriages and waggons. It is self-feeding, and has a quick return motion to bring back the work after having passed through the cutters. It operates upon four waggon soles at one time, and requires but one minute to complete the operation. It is the only machine exhibited in building, suitable for this heavy class of work.

GOLDMINING AND THE GOLD DISCOVERIES MADE SINCE 1851.

(Continued from page 348.)

The arrangement which next came into general use among Californian miners was the *long tom*. This consists of a long, roughly-made, wooden case, having a considerable inclination, and provided at its lower extremity with a sieve made of perforated sheet iron, beneath which is placed a "riffle box" divided into compartments, as in the case of the cradle, by means of slips of wood. Into the upper trough a stream of water is so directed as to fall with considerable force upon the auriferous drift with which it is charged, and this being continually stirred with a shovel, the finer particles are gradually washed through the sieve over the riffle box, whilst the coarser fragments are from time to time removed after being duly examined for any nuggets they may contain. The stuff retained by the riffles is afterwards washed in a pan, and the clean gold thus separated. The tom has the advantage over the cradle of getting through a much larger amount of work within a given time, but it requires a much more plentiful supply of water, and the loss of fine gold is great.

When conveniences exist for its introduction, the *sluice* has now generally superseded the tom. This arrangement is nothing more than a long run of wooden troughs provided with false bottoms in which augur holes have been bored to a certain depth, and in which mercury is generally placed. Through these inclined troughs the "pay dirt" is washed, and the metal, from its greater density settling in the depressions at the bottom, and combining with the mercury placed there for that purpose, is thus retained. These false bottoms are occasionally removed, and the mercury separated from the gold by filtration and subsequent distillation.

This process, although a certain portion of the gold is still lost, is generally much preferred to either of those above described.

It is also now customary, whenever a sufficient fall of water can be obtained, to direct a stream, by means either of metallic tubes or canvass hose, against the bench of pay dirt it is intended to remove. A powerful stream playing against the side of a hill will in a short time disentegrate a large quantity of dirt. The rubbish thus detached is conducted through a sluice in the usual way, and the gold is in this manner separated and collected. This method of proceeding is known by the name of *Hydraulic Mining*, and is, generally speaking, considered the most economical that can be adopted.

When, instead of being found in deposits of pay dirt, the gold occurs in veins, associated with other metals, it becomes necessary to reduce the gangue to a state of fine division before it can be extracted. Two distinct methods are employed for the separation of this metal from the matrix with which it is associated, viz., washing and amalgamation.

In some countries, and particularly in Mexico, the *arrastra* is much employed for the treatment of auriferous minerals. This consists of a vertical axis, provided with cross arms, to which are attached, by means either of ropes or thongs of untanned leather, two or more heavy masses of porphyry. Mules are harnessed to one of the projecting arms, and a rotatory motion given to the shaft. The stones thus set in motion are dragged over a well-paved bed, and thus, by an action somewhat resembling that of the common muller and slab, the ore is gradually reduced. Mercury and water are added to the ores operated on, and the resulting amalgam is from time to time passed to the retort.

In some instances the ores are introduced into the arrastra in fragments of about the size of peas, but in large establishments it is first coarsely ground in a stamping mill. It is needless to say that grinding by means of the arrastra is a slow and expensive operation.

In Chili the *trapiche* is much used. This is nothing more than a grinding mill like the ordinary edge-runner. The roller runs on a grooved bed-stone, in which a certain quantity of mercury is placed, and by the continual trituration of the revolving runner the ore is gradually reduced and amalgamation effected. This is, however, like the foregoing, a tedious and costly operation.

In some cases a mill like that commonly employed for grinding corn has been made use of, and found to answer remarkable well.

In one establishment where apparatus of both constructions is in operation, the ratio of the cost of grinding by the horizontal mill, as compared to the edge-runners, is as 2s. 3d. to 6s. 10d,

The ordinary roller crushing-mill has also been employed for the reduction of gold quartz previous to amalgamation, but it cannot be considered to be well adapted for this purpose. In the first place the whole of the stuff coming from the mill has to be passed through sieves of fine wire-gauze, and these become so rapidly worn by the rougher fragments which are being returned to the raff-wheel, as to render repairs constantly necessary, and the operation very expensive. Then, again, unless the ore be remarkably dry, these sieves choke, and the stuff is carried round and round without passing through; and, finally, if the ore be dry, such a dust is created as to nearly choke those attending to the crusher.

Among the quartz miners of California and Australia the stamping mill is now the machine almost universally employed. The ore is often first calcined in heaps or kilns, and, after stamping, the reduced mineral is passed through apparatus of various forms for the separation of the gold.

The calcination of the quartz, although not always adopted, is frequently productive of advantageous results,

Hard quartz is rendered much more friable by this treatment, and when a large proportion of sulphides is present, the expulsion of sulphur by the operation of roasting is likewise beneficial. It is also probable that when gold occurs in thin finely-divided laminæ, the ignition of the quartz causes such an agglutination of its particles as to cause them to offer less surface to the action of the water, and that the loss of "float gold" is thereby diminished.

The metal is separated from the stamped ore either by washing alone, or by washing and amalgamation. When the former process is resorted to, the stuff flowing from the stamping mill is either allowed to pass over riffle-boxes, or is conducted over blankets, or skins on which the hair is retained. These are occasionally washed in proper vessels, and the metal retained by them thus collected. The gold so obtained is, in most instances, concentrated by washing in a *batea* or otherwise, and finally amalgamated, or less frequently fused with litharge, or an ore of lead, and finally cupelled.

When amalgamation is employed, the riffle-boxes may be charged with mercury, or the auriferous sands produced can be passed through triturating apparatus containing mercury, with which the gold is caused to combine. In some cases barrel amalgamation is resorted to. The diagram on the wall exhibits a combination of three of the most efficient amalgamating appliances used by the miners of California and Australia, which is well calculated to separate the precious metal from ordinary gold quartz. The ore flowing from the mill first passes over a lip through a triturator not unlike that employed at Zell in the Tyrol, and then falls into an apparatus, the action of which is similar to that of the amalgamating barrel. Finally, the whole of the stuff before passing over riffle-boxes or blankets, is agitated in a column of mercury through which it is made to descend. In some instances, where water is not plentiful, that from which the tailings have settled is again pumped round. In this case a little wood ashes should from time to time be thrown into the mill. This is employed for the purpose of saponifying any oil or other fatty matter which, if present in *even the most minute proportions*, when quicksilver is used, would, by preventing the particles of gold from uniting with the mercury, materially interfere with the results obtained. It is, therefore, of great importance in all quartz-crushing and amalgamating establishments, that proper care be taken to prevent any dropping of oil from the bearings into the apparatus, since the result of such an accident would inevitably be a notable falling of in the produce of gold obtained. In order to prevent loss occurring through this cause it would, as before stated, be found advantageous to throw from time to time into the mill a little wood ashes or some other alkaline body, for the purpose of removing any greasy matter which may have become accidentally introduced.

When the quartz contains an appreciable quantity of auriferous sulphides, it would in many cases be found advantageous to separate these from the tailings by means of a Hnadt's buddle applied to the end of the riffles. The sulphides thus collected might be treated either by fusion with oxide of lead, and the produce cupelled for gold, or after a preliminary roasting be again subjected to amalgamation. The former process will, however, in many instances prove the most advantageous.

As an instance of the small yield of gold which, even in Australia, is at the present time found remunerative, I would quote the following results of the Colonial and Port Philip Company. It must, however, be observed that, to obtain a satisfactory profit from ores of this class, it is necessary not only that large quantities should be treated, but also that the greatest economy should be observed in every department of the manipulation.

The quantity of quartz crushed by this company between October 1st, 1860, and September 30, 1861, was 32,258 tons, from which the produce was 24,336 ozs. 6 dwts., being an average of 15 2 dwts. per ton. The quantity crushed during the preceding year was 21,693 tons, and the produce 17,466 ozs., being an average of 16 dwts. per ton, showing an increase in crushing of 10,563 tons, and on the yield of gold of 6,870 ozs. over the same period of the previous year. It will be perceived that the yield of gold per ton had experienced a variation of 22 grs., equal to 5¾ per cent. The total expenditure per ton has been 12s.; in the preceding year it was 16s. The profit on the quartz crushing for the year ending September 30th was £22,958 16s. 5d.

(To be concluded in our next.)

MEETINGS FOR THE WEEK.

Tues.—*Royal Inst.*, "On the Art of the Last Century," by Rev. G. Butler, M.A., at 4 p.m.
Soc. of Engineers, Annual *Conversazione*, at 7 p.m.
Zoological, at 9 p.m.

Thur.—*Royal Inst.*, "On Progress of Chemical Arts, 1851-1862," at 3 p.m.
Society for the Encouragement of the Fine Arts, Conversazione, at 8 p.m.
Civil and Mechanical Engineers Society, "On Various Methods of Applying Steam Power," by Arthur Chapman, Esq., at 7·30 p.m.

Fri.—*Royal Inst.*, "On Cuneiform Writing, and the Way to Read it," by Major-Gen. Sir Henry Rawlinson, at 8 p.m.

Sat.—*Royal Inst.*, "On Agricultural Chemistry," by Dr. T. Anderson, at 3 p.m.

The meeting of the Royal Geographical Society at Burlington House, originally standing for Monday the 9th of June, has, upon application from the Social Science Promoters, been postponed to Monday, the 16th inst.

The monthly meeting of the *Association of Foremen Engineers* will be held at 35 St. Swithin's Lane, City, on Saturday next, the 7th inst. Mr. Newton, of the Mint, will probably occupy the chair on the occasion, and the paper read will be one on the "Reform of the Patent Laws."

ON ADJUSTING THE NEEDLES OF A GALVANOMETER.

By J. Broughton, Esq.

In making or adjusting an astatic galvanometer, the difficulty of magnetising two needles to exactly the same intensity frequently causes the expenditure of much time and trouble, which may be greatly reduced by the following simple method of procedure:—

Let the two needles be as nearly as possible of the same dimensions; a piece of watch-spring will make a good pair for a large instrument. Then, after strongly magnetising them, suspend each singly by a piece of fine silk, and producing a definite deflection by means of a magnet, allow the needle to return to rest, counting the number of oscillations it makes in a constant time (say 1½ minutes). The needle that makes the greater number will be the more highly magnetised, and will probably require, as the case may be, a very slight touch with the similar pole of a magnet in order to reduce its magnetism to the intensity of the other needle, which can be readily managed after one or two trials in the above manner. When the two needles are subsequently superposed with opposed poles, and finally suspended with the lower one between the coil, the pair will be found to retain but little polarity. The needle whose directive force still preponderates can then be readily detected, should it not already be determined by the position of the pair,—by carefully holding at the distance of about two feet from one end of the pair and equidistant from each the north pole of a magnet, and noticing whether the two nearest ends are attracted or repelled. Should the former be the case, it will then be the needle whose south pole is nearest the magnet whose magnetism is still in excess, which must be slightly demagnetised by holding for a second the north pole of a magnet at the distance of two or three inches from that of the needle. By proceeding in this manner and by noticing the deflections produced by a weak current, as that of a single thermo-electric pair, the needles may be quickly rendered astatic, which will be indicated by the extreme slowness of their oscillations and by resting equatorially.
—*The Chemical News.*

COLLINS' IMPROVED APPARATUS FOR REEFING AND FURLING SAILS.

This invention, patented by Mr. J. S. Collins of Liverpool, relates to the reefing, furling, unreefing, and unfurling of all sails, square or fore and aft, but especially to top sails wherever yards, booms, spars, or such like mechanical contrivances are placed at or near the top and bottom of, and connected to the sails, and consists in placing on or near the ends of the lower yard, boom, spar, or other apparatus framing to carry chain wheels movable on an axis; attached to and stretched between the said wheels is a chain, parcelled with coir or other fibre to give it stiffness, a spar, rope, or any other article to which the foot of the sail can be lashed or otherwise fastened, the other parts of the sail being left as at present. Over the chain wheels above referred to, as placed on the ends of the lower yards, chains are passed and carried or continued thence round or over cheek sheaves, blocks, or other guiding arrangements near the chain wheels, and also about the middle of the yard near the mast down to the deck, where the "halyards" are operated upon at the same time as the top halyards, thus causing the chain wheels to revolve and wind on the parcelled chain or other parallel rod or rope, or unwind from the same, as much of the sail as may be desired, keeping the whole "taut" and secure from the wind, and enabling the operation of taking in one or more reefs, furling and unfurling, to be performed from the deck, and obviating the necessity of sending men aloft.

The leading feature of this apparatus is entirely different from all other revolving systems of reefing, furling, unreefing, and unfurling the sails of ships and other vessels; in the apparatuses at

Digitized by Google

COLLINS' IMPROVED APPARATUS FOR REEFING AND FURLING SAILS.

Fig. 1.

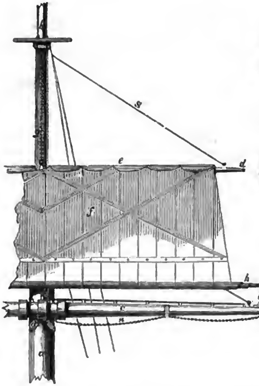


Fig. 3

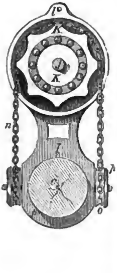
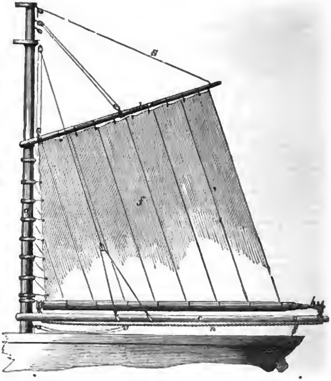


Fig 2.



present in use the principal revolving parts are placed near to the upper yard, boom, or spar, form part of the same, or are attached about the middle of the sail itself, and communicate by ropes or otherwise with the said upper yard, boom, or spar; but in the system above described each sail is wound on or from its own "foot." None of the new parts employed are directly connected to or work immediately with the said upper yard, boom, or spar.

Fig. 1 is a front elevation of so much of the masts, yards, and rigging of a ship as is necessary to illustrate the above arrangements; the chain wheels which communicate the rotary motion to the foot of the sail being at right angles to and on the top or above the yard, and the sail close reefed; Fig. 2 is a side elevation of part of a sloop, showing the same arrangements applied to fore and aft sails; and Fig. 3 is a vertical section of the apparatus for communicating the rotary motion to the foot of the sail.

In Fig. 1 *a* represents the lower, *b* the top mast; *c* the lower yard; *d* the top or top sail yard; *e* the jack stay; *f* the sail; *g* the halyards passing through the mast in the usual manner; *h* a chain parcelled with coir or other fibre to give it moderate stiffness, a rope, spar, or other suitable apparatus, the ends of which are made fast to the eyelets of the centre shaft *j* of the chain wheels *k*, Fig. 3, which work in the framing *l* fastened on and to the yard *c*. Instead of attaching the "foot" of the sail *f* to the apparatus *h*, the "foot" may be stretched between the eyelets and fastened to the same. *m* friction balls running in corresponding grooves in the framings and chain wheels *k*, to allow the latter to rotate freely when the chains *n* are drawn either way. These chains are passed over the chain wheels *k* and cheek sheaves inside the framing, thence through the blocks *q* down to or near to the deck, where they can be attached to the ordinary winch, or otherwise fastened and worked as found most convenient; a moderate tension is desirable, so that the chain may not slip over the notches of he chain wheels *k*, and this is best attained by having for each wheel an endless chain with just sufficient slack for convenient working. When the top-sail yard is hoisted or raised above the cap of the lower mast in vessels with large sails, it will be necessary to have some means other than, or as an assistance to, the halyards *g* and lifts *s*, of keeping the yard close up to the mast and strengthening the arrangement.

SCREW STEAMERS FOR WAR AND OTHER PURPOSES.

One of the most promising and satisfactory circumstances connected with the impending changes in the mode of constructing our ships of war, is the energy and ability with which engineers and naval officers are devoting themselves to the question. They see clearly enough that the British Navy is in a state of constrained transition, and with all the adaptability which is characteristic of the British character scientific men seem determined to work out the problem—how to construct the best ships, and arm them most efficiently. The Admiralty is beseiged by applicants who desire to have its powerful aid in developing their plans, and in testing their schemes for the improvement of our naval defences. Although the Lords of the Admiralty may thus find their offices anything but sinecures, we cannot but regard the causes of their immensely increased duties as at once a hopeful and wholesome sign of the times. Whether the Board of Admiralty, as at present constituted, may be found equal to the great occasion, is another very important question. The scientific and practical elements are those most needed at present at the Admiralty council table, but whether they exist to a sufficient extent thereat is a debatable point. Our own opinion is, that they do not, and that ere long it will be found necessary to associate with "My Lords" some eminent engineers who may assist in their deliberations, and thus enable them to arrive at sound conclusions. In saying this, it is not our intention to detract in any way from the merit and reputation of the existing Board of Admiralty, or to depreciate the services of other subordinates at Whitehall or Somerset House. On the contrary, we would render them all praise, and it is simply with a view to making the Institution thoroughly effective that our suggestion for incorporating with it more practical talent is made. Eventually this will have to be done, and the sooner steps are taken for its accomplishment the better. It is next to an imposibility for men who have not themselves been educated in the school of mechanical and practical engineering, to comprehend and do justice to the plans of those who have so been educated and who have taken out their degrees, not in the University, but in the workshop, the factory, or the ship-yard. Among the various plans which have been submitted to the Admiralty and the public for the remodelling of ships of war, and which demand at least attentive consideration, are those of Captain Symonds', R.N., and Mr. Roberts', C.E. These, indeed, were recently developed by those gentlemen, with much care and elaboration, at the Royal United Service Institution; and we have pleasure this week in directing them to the notice of our readers. It will be scarcely possible, however, for us to embrace within the compass of a single article, the varied points of naval economy to which Captain Symonds, on the occasions referred to, called the attention of the members of the institution. It will be more convenient to ourselves, and much more fair towards the gallant officer, and his coadjutor Mr. Roberts, if we, on the contrary, confine our remarks to one section of the subject—that relating to "light draught coast defence ships"—and reserve other portions for future notice and comment. In order to elucidate with more certainty the plans of Messrs. Symonds' and Roberts' we append a series of illustrations, which in truth render those plans unmistakably intelligible:—

Fig. 1 is a general exterior view of a light draught coast defence vessel, showing a proposed method of protecting the guns by inclined armour-plated sides, rounded from the deck upwards, and terminating in a rounded platform or deck. The

SCREW STEAMERS FOR WAR AND OTHER PURPOSES.

FIG. 1.

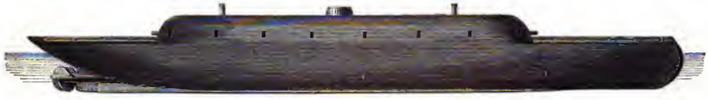


FIG. 2.

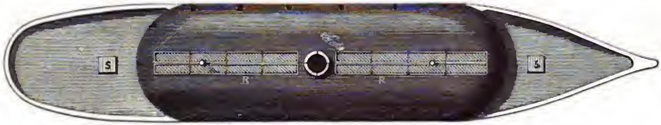


FIG. 3.

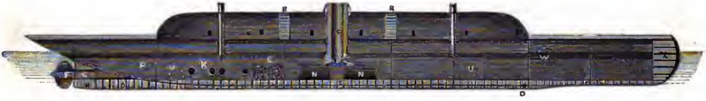


FIG. 4.

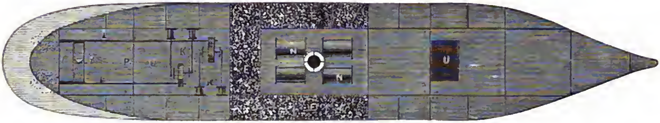
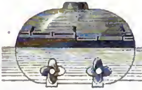


FIG. 5.



top sides forward and aft are fitted to lower when bow or stern guns are used.

Fig. 2 is a deck plan showing a method of giving ventilation and light, and of relieving the gun deck from smoke. These desiderata are effected by means of a strong iron grating *R*, in which are hatchways for giving access to the deck for boarding or repelling boarders. *S S*, are other hatchways similarly fitted for ventilation and access to other parts of the ship.

Fig. 3. Longitudinal section showing internal arrangements.

T, Bread and provision room.

K, Engine room.

E, Athwart-ships coal bunkers.

N, High-pressure cylindrical boiler, with method of fitting the uptake to funnel, and the cellular casing round the funnel to give ventilation in the boiler room—similar arrangement round mast to ventilate boiler deck. The funnel is telescopic, and when run down, as in action, would project only three feet above the deck. The draught in such case is given by means of Clark's adaptation of the steam jet, which also prevents smoke.

U, The magazine.

V, Chain locker.

W, Windlass on improved principle.

X, Form of stem for receiving the prow of opposing rams, and method of strengthening the bows to resist the shock, being in fact a series of short decks, or breast hooks.

Fig. 4. Arrangement of longitudinal bulkheads, forming cellular girder, with the side applied at coal bunkers, water tanks, and to other purposes.

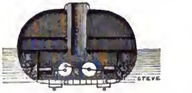
Fig. 5. Stern view, showing the two screws by which it is proposed to propel the ship, and which are of a novel, and, as we think, admirable form. Three stern chase guns are also shown, with gunwale lowered on starboard side.

Fig. 6. Section in engine room with projected arrangement of engine *K*; coal bunker *E*; and cellular bottom and keels *C D*.

It will be observed that the whole of the arrangements proposed in connection with the light draught defence ships have the merit of novelty, at least, to recommend them. The size of the vessels suggested to be built and armed as above shown, is as follows:—Length over all, 240 feet; breadth, 45 feet. The draught would be 15 feet; they are each calculated to mount 14 guns, and their height above the water line would be 8 feet 6 inches.

With regard to the armament, Captain Symonds proposes that two of the guns should be of very heavy calibre, and that one of these should be placed forward and the other aft. They would thus constitute bow and stern chasers to be fired in a line with the keel, as shown in illustration. The guns on other side may be fired in the same direction when necessary, or as broadside guns. Thus three guns can be brought into action, whether chasing or retiring, and six on the broadside.

FIG. 6.



We are glad to perceive that Captain Symonds has not lost sight of a very important subject in reference to the internal economy of steam ships, whether for war or other purposes, and that is the introduction of labour-saving machinery on board them. We have on several occasions directed the notice of the Admiralty to the same thing. Very many of the operations afloat, now performed by manual exertion, might certainly be accomplished without the action of sentient bone and muscle, if only a little ingenuity were devoted to effecting the improvement. The windlass of Captain

Symonds' is a case in point. Without going into further details as to the construction of the "light draught defence ships" of Captain Symonds' and Mr. Roberts', and which space indeed forbids us to do, it must be permitted us to say that they combine a great number of valuable improvements, and in some respects seem to us far superior to the cupola vessels proposed by Captain Cowper Coles. A score of such ships would form a fleet which would be calculated to render a good account of an invading enemy. The extreme facility with which they might be handled and manœuvred, the small space in which they would be made to turn, the next to an impossibility of the screws "fouling," and their invulnerability, make them worthy the careful notice of the Government, and to that we confidently commend the plans of the gentlemen in question.

We are aware that but scant justice has been done to the designers of the "light draught war ships" who really deserve something more than mere approbation for the complete way in which their designs come before the public. Those gentlemen evidently combine within themselves two essential qualifications for ensuring success, namely, extensive nautical experience and sound engineering knowledge. In the construction of the fleet of the future, these elements must, as we have said, predominate much more largely than they have hitherto done—that is, if England is to maintain her long held supremacy at sea.

In the course of the discussion which followed the reading of Captain Symonds' paper at the United Service Institution, Mr. Samuda took some exceptions to the plans proposed, but they were not of a sufficiently grave nature to warrant further notice of them at present. Possibly, when reverting to other sections of the paper the objections of Mr. Samuda may be considered.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

May 13 *and* 20.—John Hawkshaw, Esq., President, in the Chair.

The first paper read was—

The Malta and Alexandria Submarine Telegraph Cable.

By Mr. H. C. Forde, M. Inst. C.E.

It appeared that in May, 1859, Her Majesty's Government determined that a telegraph cable should be laid between Falmouth and Gibraltar, and the late Mr. Lionel Gisborne and the author were appointed joint engineers. Subsequently, and after some progress had been made with the construction of the core and the outer covering, it was proposed to use the cable to join Rangoon and Singapore. This idea was, however, abandoned, and in January, 1861, it was decided that it should be laid between Malta and Alexandria, an operation which was carried out in the summer of that year, the communication having been successfully completed on the 28th October, 1861.

The recommendations of the late Mr. R. Stephenson and Sir Charles Bright, as to the form and size of the cable to be used between Falmouth and Gibraltar, were then referred to; and it was stated that iron covered cables, of three sizes, were designed for the varying depths up to 600 fathoms, and for the greater depths, across the Bay of Biscay, a cable covered with twelve steel wires, each enveloped in a hempen strand, laid in a spiral form. The latter was abandoned when the destination of the cable was changed; but the other forms of outer covering were retained, as considerable progress had been made with their manufacture. If it had been known at first that the cable would be laid in comparatively shallow water, a different design would have been adopted. The outer wires were much larger than those of the Atlantic, the Red Sea, and the other Mediterranean cables containing a single conductor, and the conductor was nearly four times the size of the Atlantic cable, and twice that of the Red Sea cable.

The contract for the manufacture of the core was entrusted to the Gutta Percha Company; the contracts for the outer covering, and for laying and maintaining the cable for thirty days after completion, were let to Messrs. Glass, Elliot, and Co. The conditions of the contracts were then given in detail, the main features being that the core and the cable were to be kept continually under water, during the manufacture and the laying, and that the electrical tests were to extend from the commencement of the manufacture until thirty days after submersion of the whole line. The different processes involved were next described, and it was stated, that under a pressure of from 600lbs. to 800lbs., the electrical condition of the core improved about 10 per cent. The relative resistance per knot, both as to conduction and insulation, of the Atlantic, the Red Sea, and the Malta-Alexandria Cables, was represented by the numbers 1, 4, and 37. It was requisite that great care should be observed in making the joints of the core, of which there were four thousand two hundred in the Malta-Alexandria line, as the slightest imperfection in any one would be attended with danger.

A difficulty having arisen in keeping the cable permanently under water, one portion became exposed to the air, and was allowed to dry. When tested, a loss of insulation with increased resistance in the conductor was observed. An investigation by Dr. W. A. Miller, F.R.S., showed that this deterioration was due to heating, from the effects of oxidation. It was consequently resolved, that the original idea of fitting ships with water-tight tanks should be carried out. The way in which this was accomplished, and the manner of coiling the cable on board, were then alluded to. The eye of each coil was fitted with an open framework of timber, by which arrangement a fault was cut out of the centre of a large coil, without its being necessary to uncoil the whole cable, as would have been the case with a solid eye.

Previous to commencing the operation of laying, the route was most carefully surveyed by ships of the Royal Navy, when it was ascertained that the Admiralty charts were in parts incorrect in latitude, and were deceptive as to the soundings, the general depth and the conformation of the sea bottom being very different to what they were represented to be on the official charts.

Each ship was fitted in the following manner: A large V sheave, furnished with a small friction band, was suspended above the centre of the hold, and over this the cable was led. The paying-out apparatus, placed on one side of the stern, consisted of three V sheaves, in one vertical plane, and parallel to the centre line of the vessel, each sheave being provided with a friction strap. The cable was passed over these sheaves under three weighted jockey pullies, to the brake drum, round which it took three or four turns; then over a fixed sheave, and under a moveable weighted pulley, into the sea over a fixed stern-wheel at the level of the last sheave. The dynamometer employed was similar to that used on the occasion of the successful laying of the Atlantic cable.

The first portion of this line was laid between Malta and Tripoli, the greatest depth being 420 fathoms. The cable was paid out at an average rate of 4·94 knots per hour. The maximum strain to which the heavy shore-end was subjected was 20 cwt., but with the main cable this did not exceed 12 cwt. The estimated slack paid out in the deep water was not quite 5 per cent. No difficulties of any kind occurred, until attempts were made to splice the main cable to the Tripoli shore-end, which had been laid by another ship. Nine unsuccessful attempts were made, owing to bubbles forming under the fresh gutta percha, but by cutting off a length of 25 fathoms of the shore-end, a perfect junction was effected. The remaining cable on board this ship was laid in the direction of Benghazi, the maximum depth attained being 150 fathoms, the average speed of paying out 5·3 knots per hour, and the greatest strain 9 cwt. The cable next laid was part of the third section, commencing at Alexandria, and extending nearly 300 miles to the westward, towards Benghazi. The roughness and irregularity of the bottom rendered this operation very critical; but by carefully selecting and laying out the route to be pursued, after accurate soundings had been made, and by only paying out in daylight, it was successfully completed. Six days were occupied in laying 128·8 knots of heavy cable and 153·32 knots of main cable, or a total length of 282·12 knots. Thirty-two buoys were laid down to mark the route, and upwards of sixty different courses were run. The maximum depth of water was 102 fathoms, the minimum, for a short length, was 13 fathoms, and the average 38 fathoms. Subsequently, the second part of the third section between Alexandria and Benghazi, and the second part of the second section between Benghazi and Tripoli were laid, and the communication was established. No accurate estimate could be made of the actual slack paid out, but as a general rule in depths under 100 fathoms, from 2 to 2½ per cent. was the utmost that could be got out of the ship when the cable was running quite free. The angle at which the cable was paid out ranged from 40° to 45°. The maximum speed was 7·15 knots, the minimum 4·5 knots, and the mean 5·25 knots per hour.

Respecting the tests during and after the laying, it was observed that as the cable was paid out, its electrical condition invariably improved; the highest resistance being found in the deepest and coldest water, and the lowest in the shallowest and warmest water. Experiments as to the rate of working showed that the speed attained agreed very nearly with that which had been anticipated, namely, five words per minute through a length of 1,100 knots, except through the short sections, where the limit of the speed depended simply upon the skill of the clerk.

The communication was accompanied by a map, showing the general course of the cable, by a longitudinal section of the sea bottom, and by diagrams of the electrical tests. Specimens of different cables were also exhibited.

(To be continued in our next.)

TO CORRESPONDENTS.

Received.—E. P., J. D., Subscriber, J. I., R. W., C. S., W. N. D., F. S., Capt. N., G. B.C., R. N. E., B. and M., B. G., W. W., Enquirer, J. B. (can't say), W. H. B. (write to the Armour Plate Committee), Capt. L., C. W. L., "Photography on Wood" (next week), "A New Test for Targets" (next week), "Working Engineer" (too late), E. S. R., E., Maw, J. Bangor, G. S.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

MR. SCOTT RUSSELL'S TARGETS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I am sure you feel a sincere interest in the promotion of just views on the subject of iron-coated ships, and I therefore think it my duty to add more facts to those which were adduced in your last number. Had your informant stated the following facts, your opinions and my own would not, I think, differ so much as they seem to do.

1. There were various kinds of experiments tried on one target, which should be distinguished from each other. For example: the continuous riveting was of two kinds—flush—and round headed.

2. There were two classes of plating used; the ordinary broad plates about 3 feet wide, and also some exceptionally narrow plates.

3. The target was, one not made for these experiments, but which was already in the hands of the Admiralty, intended for another use. So were the plates. Both had the disadvantage of being less fit for their purpose than if originally designed for it. The targets of other constructors were expressly prepared for their special use. This explains how narrow plates came to be used: in one part the plate was narrow because the target would not admit a wider one, and in another, because the proper width was not in stock.

4. It is a fact, that of the ten rounds of shell, not one penetrated the armour.

5. It is a fact, that of the eleven rounds of 110-pounders, 120-pounders, and 68-pounders, not one penetrated the armour.

6. It is a fact, that the two 156 lb. shots from the 300 lb. gun, with 50 lb. powder, were stopped by the armour, and failed to penetrate it.

7. It is a fact, that a narrow plate was selected, which all who were present knew could not resist the 156 lb. shot from its want of weight, and of course it was broken through.

8. It is a fact, that neither a fragment of the shot or the plate did go through the inner lining of the target even where it was broken through by the aforesaid 156 lb. shot.

Now, sir, with all those incontestible facts established by the trials of Friday week, I am perfectly satisfied to have any quantity of minute criticism, or of fair difference of opinion. I do not wish to convert any one to my opinions; but I only wish to have mine fairly put along with their opposites.

My opinions on the experiments are as follow:—

1. I think it was proved that Armstrong shells will crack and break narrow plates of 4½ inches thick. By narrow plates, I mean anything nearer 2 feet than 3 feet wide.

2. I think it proved that the usual width of

3 feet plating, on any system, has successfully resisted penetration of all shot less than 156lbs., even with their greatest charges.

3. I think it proved that no other target than mine, with 3 feet 4½ inch plates, has kept all shots from penetrating the armour. All others have been penetrated; most of them by the smaller weights, and all of them by the greatest.

4. I think that while mine has kept the 156lb. from penetrating the armour, which the Warrior target failed to do, my target has the same advantage as the Warrior is said to have, of not injuring the water-tight inner skin; a water-tight inner skin of half-inch iron, about 2 feet from the outside, being an essential part of my design, and as such partially shown and completely proved in the experiment.

5. I do not deny that a *target* on my system is heavier than the Warrior target. I do hold that a *ship* on my system is lighter, stronger, and much more durable than a Warrior ship with wood backing.

6. I do think that the flush continuous rivetting, being more protected from shot than the round rivetting, and getting rid altogether of holes in the armour, is the best fastening I have seen.

I remain, your obedient servant,
J. Scott Russell.

20 Great George-street, Westminster, 5th June.

◆

THE SPITHEAD FORTS *v.* MACINTOSH'S SYSTEM OF ATTACK.

Sir,—Having read the report of the Defence Commissioners, I see nothing to alter the opinion I formed some nine years ago, and which appeared in your valuable paper during the Crimean War, viz., that by my system of attack, all sea-face fortifications can be rendered untenable, although, from Sir William Armstrong's examination, the Commissioners conclude that the forts are necessary for the defence of the country, as he believes that no armour plates which could be forged was proof against a large gun, with an enormous charge of powder; and, if successful in rifling the 22-ton gun, he will shatter the sides of anything afloat at a range of 300 yards.

I concur in the conclusion of the Commissioners, having reference, as I presume, only to the present and possible improvement in ordnance, iron-plated vessels, and forts; but I do not think they would retain their opinions if my mode of warfare was introduced.

The time has now arrived when my system of warfare will no longer be repudiated as barbarous. The wholesale destruction by steam rams at once settles the question, and the introduction of my incendiary shells, and the application of chemical agents to be used in war, would render the strongest forts that human agency could construct quite untenable.

The question will then arise, if these agents are already partially known, or must necessarily become so, is it wise or prudent to neglect those means which, while we preserve our supremacy at sea, will prevent their being used against us, and, furthermore, would be an effectual safeguard against all attack?

These are from great consideration, and well-worthy of the consideration of the nation; and I venture most respectfully, but, at the same time, most urgently, to beg that this matter should not be again dismissed without due deliberation.

I will now ask, what resistance could the proposed forts at Spithead, armed with guns of the heaviest calibre, offer to an attack on my system, as they are approached under cover of an impenetrable fog, produced by discharging inflammable liquid from suitable shot-proof steam vessels, of light draught and great speed? This inflammable liquid ignites spontaneously, instantly generating a dense, black cloud of suffocating vapour, enveloping the forts, rushing into the casemates, destroying everything combustible, and rendering the air in the forts highly explosive, and pernicious to life. The attacking party may then take up positions suitable for discharging a few of my incendiary shells, the bursting of which scatters the contents in all directions, and the shower of inflammable material falling among troops, ignites spontaneously, causing immediate disorganization and destruction. Fired into harbours, dockyards, or towns, the result is alike destructive and decisive.

Lord Palmerston's proposition to the House of Commons, prior to the commencement of the Spithead Forts, refers to the fortifications at Cronstadt and Sebastopol having baffled our officers, "gallant as they were, and strong as were their fleets;" but our gallant officers' attack was of the old school, which consists of blowing away thousands of tons of small pieces of iron at a range more noisy than dangerous. Had they adopted my system of attack, our admirals would have been enabled to take up the position necessary for destroying the works, unmolested by the enemy's fire. I may add that if our navy was composed of Warriors and cupola vessels, our inadequate powers of attack upon sea defences would remain the same should the fort be plated with iron. "Our National Defences" are, in reality, our ships of war, and we must maintain our maritime supremacy at any cost, which can be done by attaching to portions of our fleet an "Incendiary Steam Brigade" as an auxiliary power of attack, which would, I believe, be the only means of securing our naval supremacy. This "Incendiary Steam Brigade" to be composed of iron steamers, rendered shot-proof, of light draught and great speed, furnished with receptacles suitably arranged for carrying and discharging my inflammable compound; such vessels can enter harbours submerged, which no forts can prevent. In attacking iron-clad vessels, from their superior speed and quick manœuvring, they will always keep in contact with their opponents, discharging quantities of inflammable material, which nothing living or combustible can resist, burning fiercely on iron, in the muzzle of guns, or on the water.

I will not enter into the more general question, whether such destructive agents will not in the end rather tend to diminish war? but I wish to point out that before any further sums are engaged to be expended, and while the future modes of warfare are in a transition state, the means by which such expenses may be avoided, with, moreover, a vast diminution of annual expenses, and increased safety of the country. Your obedient servant,

John Macintosh.

June 4th, 1862.

◆

COPPERING IRON SHIPS.

London, May 31st, 1862.

Sir,—In your paper of to-day, as well as in your last, you notice the proposal of Lord Clarence Paget to form a committee to report upon the means of coppering iron ships, on which, as his Lordship says, "the future of our navy greatly depends."

Now I have for the last ten years urged the necessity of this on the Government, from a full consciousness that the discussions as to whether we are to have "iron hulls" in the navy entirely depends on this. It is the undecided state of this question that in the House of Commons and out of it has kept the subject in suspense; and why such an important question remains to this day untried must be a marvel to all impartial men.

But, stranger than all, some of the iron-ship builders, whose business would be so largely increased if the question was settled, have thrown cold water upon it, upon the amusing pleas that a remedy is not wanted, and that I am going back to wooden ships in proposing to sheath them. On the other hand, the timber ship builders of our dockyards know that if my plan succeeds it would finally decide the question of wood *versus* iron, and put a stop to the last effort that is now being made to hold on by wood a little longer. For not only does my plan provide for iron ships being sheathed with copper, but also protects them where they are *locally weak*, in sudden concussions from hard bodies under water.

I do not here describe the plans proposed, as you have already given full and favourable notices of them; but I now allude to them to show that the proposal to appoint a committee can have no result, and their report must be altogether valueless. Nothing will exemplify this more clearly than the parallel case of the armour plates for ships, and how the endless opinions, discussions, and reports have been shown to be mere waste time and paper, against the few simple but effect experiments lately tried at Shoeburyness.

The government wisely allowed several targets to be made to the plans of some of our most practical men, and it was amusing to see the blank astonishment with which their favourite theories were sent to the winds by a few unceremonious shots from Sir W. Armstrong's 300-pounder.

Now, what I also ask for is simply a trial. Ten years have already been lost in this matter. If I am unsuccessful, the whole can be stripped off and the vessel be perfectly serviceable. If only partially successful, much experience will be gained and no harm done. If, on the contrary, I am *successful*, of which I entertain no doubt, the whole remaining difficulties are cleared away, and iron alone will be used in the navy as in the merchant service.

I am, Sir, your obedient servant,
John Grantham.

IRON FLEETS OF SMALL COUNTRIES.

Sir,—Will you allow me a short space in your valuable magazine to offer a few suggestions to the small country of Holland, where your paper is widely circulated.

The gentlemen of the profession there, I have no doubt, are putting their heads together to come to a resolution as to how reconstruct their navy.

Now, being a Dutchman myself, and watched the progress they have made in naval architecture (for Holland can boast of some very fine ships), I have no doubt that, like England, they will cease building wooden men-of-war, and substitute iron ships instead.

As they have already obtained from this country some gratuitous information about their smaller craft, let me suggest to them to stop building these ugly square tubs. They want vessels of speed and light draught for the coast defences, and good sea-going ships for the colonies. Small countries like Holland should not waste their money upon big vessels. Let them have a good fleet of swift light draught gunboats (they need not be tubs), carrying from one to four of the largest guns, to keep their larger enemy, who cannot enter their waters, at bay; further, let them have larger craft, from ten to twenty guns. Also swift ships, and able to be used as rams. Larger ships than the above are no use to them, and would only be a waste of public money. In a rich country like England money is the last consideration; while in smaller countries money is the main point.

Let them have a few of the smaller gun-boats contracted for here in this country, so as not to be behindhand. In the meantime, they can be converting their wooden walls. They need not have cupola ships; other invulnerable and mischievous craft can be designed. I remain, yours respectfully,

T. Quant.

7 Amersham Vale, New Cross, S.E.

◆

ATLANTIC TELEGRAPHS.

Sir,—I am at a loss to know why Mr. Saward, in his letter which appeared in your last number, should object to my pointing out the consequences of adopting his own argument. In my first letter, I expressed my opinion that the endeavour to work at a high speed through the old Atlantic cable had fatally injured it, and I quoted Mr. Saward's own evidence as to the needlessly high battery power used, in support of my views, which coincide with those of Mr. Whitehouse, the Company's electrician at the time, who, in a letter published in October, 1858, after censuring the reckless manner in which enormous power had been used after he left Valentia, went on to say, "The use of these measures has been the cause, doubtless, of the manifest deterioration in the condition of the cable at the Irish end, which commenced not long after my recall from Valentia." Mr. Saward replied to my letter, saying that the great power in question had been used at the time in order to overcome faults then existing in the cable, and not to work fast through the line. I then expressed my disbelief in the possibility of such a destructive process having been in operation, while the directors were daily publishing reports of the cable working perfectly, and while the shares were changing hands. Mr. Saward is indignant at this, and says, in reply, that neither he nor the directors knew anything about the state of the cable at the time. I might ask, of what use were they then? and why did they put out such glowing reports if so utterly ignorant? But he must surely forget that (as shown in my first letter) Mr. Gurney, the chairman, and Professor Thomson, another of the directors, were at Valentia on the very day that the message to Mr. Cyrus Field, which I referred to, was sent, and that the latter gentleman had charge of the testing of the cable throughout its submersion, and was then in charge of the electrical operations at Valentia. Mr. Gurney, the next day (the 26th of August), sent a message to Mr. Field, congratulating him on "the success of the Atlantic Telegraph." Does Mr. Saward mean that Professor Thomson did not know whether or not there were any more faults in the line than those which were taken out during the laying, which may have been those referred to in the obscure data which I mentioned in my first letter?

I am, for my part, confirmed in my former opinion that the line was in good order (until too much power was used to work through so long a circuit), by all that Mr. Saward has stated during this discussion. I will only say, in reference to the Northern route, that he is altogether misinformed as to the distances. I do not know whether Dr. Wallich has been asked to report upon that route; probably not, as he is neither sailor nor engineer; but in a discussion at the Institution of Civil Engineers, early last year, he said that "he had not observed any difficulties which might not be overcome by engineering skill." Sir Leopold McClintock, Sir Edward Belcher, Admiral Fitzroy, Captain Sherard Osborne, Dr. John Rae, Governor Rink, Allen Young, and many other practical men have passed their judgments in favour of the line, and I would rather take their opinions on the subject than those of Mr. Saward or any other landsman, especially if unacquainted with the route by personal inspection of the various points.

I could fill your pages with testimony on this point, as well as regarding the difficulty of working through long circuits, and the laws which regulate the speed as the length of the line increases. The evidence taken as to the retardation of long lines before the Cable Committee is very distinct on this point, and I need only refer those who are interested in the subject to the conclusive statements at pages 11, 138, 141, and 157 of the Blue Book on Submarine Telegraph recently published by Government.

Mr. Saward seems to construe my last letter to be offensive. It was not my intention to say a word unpleasant to him or any one else. Public enterprises and the acts of those having charge of them are proper subjects for discussion, and it occurs to me that the Atlantic telegraph cannot, with propriety, be exempted from the rule. SHORT CIRCUIT.

◆

CUPOLAS AND FORTIFICATIONS *v.* MACINTOSH'S SYSTEM OF WARFARE.

SIR,—In reading a letter in the MECHANICS' MAGAZINE of the 30th ultimo, signed "Useful Effect," induced me to inquire into the matter. I find in a patent granted to John Macintosh in 1855 for the "application of incendiary materials to be used in warfare," which was stopped by the Government, and in another patent granted to him in 1852 for "the firing of guns under water by the aid of vulcanized India-rubber, together with a self-plugging lateral explosive shell." If these inventions will be only half as effective as the inventor believes them to be, and if firing under water in close contact with an opponent is practical, what is to become of our proposed fortifications, or our armour-plates, which extend four feet below the line of floatation, whether on wooden or iron bottoms, against submarine artillery?

Your obedient servant,

June 4, 1862. NAUTICUS.

Gossip.

There can be little doubt that railways and canals are destined to change the face of British India, for the former may be already counted by thousands of miles and the latter are progressing in several districts. The line of railway at present attracting most attention is that which is to connect Bombay with Calcutta. The progress of this line may be thus briefly sketched:—From Bombay towards Jubbulpore it is completed for 250 miles, leaving about 350 in course of formation. A good road has been made from Jubbulpore to Benares, a distance of 180 miles, the transit over which may be computed at twenty-four hours. From Benares to Calcutta, 500 miles, the line is nearly completed. The line from Beypore on the western side of the continent to Madras is already completed, and Sir Bartle Frere, the newly appointed Governor of Bombay, has lately travelled over the entire distance, and soon it will be opened for public traffic.

On Monday last a meeting of the Inventors' Institute was held at their temporary offices, 26 Great George-street, Westminster, when the rules and regulations for the society were passed. Its objects are:—1st. To protect inventors' interests, and defend the privilege of obtaining Her Majesty's letters patent. 2nd. To promote improvement in the patent laws. 3rd. To facilitate the diffusion of information in reference to inventions and other subjects beneficial to inventors and patentees. The association consists of inventors and others desirous of improving the manufactures of the country. The annual subscription is one guinea.

We perceive that Mr. George Rennie, sen., has, after a lengthened and honourable career, seceded from the engineering establishment with which his name was associated. Those who are aware of the amiable character and high attainments of that gentleman—and all who have had the happiness of knowing him must be so aware—will regret that he is now leaving a post which his conduct dignified, and whereat he obtained so many mechanical triumphs. It is to be trusted that in the calm retirement which his active and useful life entitles him, in this the evening of it, to hope for and expect, Mr. Rennie may enjoy the consolation which springs from a consciousness of rectitude, and the society of dear relatives and friends. We trust, moreover, that he may survive his secession from the Holland-street Works for yet many years to come, and see his two sons walking, as they seem to be, worthily and successfully in his footsteps. Henceforth, the establishment at Holland-street, and that at Greenwich, will be conducted by Messrs. J. and G. Rennie, who, in fact, will constitute the firm.

The following choice specimen of English composition is daily distributed in the Western Annex:—"Balthasar Danzer, manufacturer of Bellows a Music, recomends his theuv-pre-du-cing apparatus made for the irrigation of tender plants and calculated dr destroying plant lice. Price L4. s. 16. His second apparatus intended for domestic use serves for the pur pore of destroying bugs baties cock reaches and all other noisome chafers in house a Kitchens. Pr. 6s. 6d."

NEW LIGHTHOUSE AT GREAT ORMEHEAD.—The works of excavation, construction of roads, raising of smithies and workshops, perparatory to the erection of a lighthouse on the summit of the huge rock on the Great Orme, usually called "Y Pen Mawr," have been commenced. The site selected for this long-needed aid to navi ation is on the most northern point of the Gogarth promontory, and commands a view of Beaumaris bay and the Menai Straits, with the Anglesey coast, as well as the headlands of Flintshire, &c. As part of the mountain lies nearest the direction of vessels sailing up and down the borders, the danger has been much felt by the mariner, and hence the necessity of proper lights and signals for protection against wrecks and damage, especially when the heavy sea, peculiar to the place, at certain tides, becomes uncontrollable, and breaks against the rock with much fury. The spot is a little below the walk round the Head, near the half-way mark, on the east side.

MEAN TEMPERATURE OF THE AIR.—The Academy of Sciences has received a communication from M. Becquerel, showing that there exists a vast difference between the temperature of the atmosphere close to the ground, and that measured at an altitude of from 60 to 70 feet above it. The soil, its nature, colour, and the objects which cover it, all influence the temperature within the above limits. It had long been observed that vegetation varies according to height, and that certain plants which cannot be cultivated in the valleys, will thrive very well on the tops of the adjoining hills. Often, also, frost will injure the flower of the vine, and respect that of the almond tree close by, which grows at a greater altitude. M. Martins, Director of the Botanical Garden at Montpellier, has observed that laurel, fig, and olive trees die away in the lower parts of his garden, but are spared a few metres higher up, though in both cases protected by the same contrivances. M. Becquerel states that the mean temperature of the air at the Garden of Plants, during the year 1861, increased regularly from one metre to 33 metres above the soil, and this circumstance has prompted him to endeavour to fix the altitude of which the temperature represents the real average at a given spot. He has remarked the curious fact that at 6 a.m., all the year round, the temperature is the same at any altitude not exceeding 21 metres; 6 o'clock a.m. is, therefore, a critical period of the day, the temperature of which must stand in a certain relation to that of the month or year, and this relation he expresses by certain co-efficients, which vary according to the different seasons, and reach their *maximum* in summer, and their *minimum* in winter. These co-efficients and the mean temperature at 6 a.m., will determine the temperature of the air at a given hour and altitude.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

STEAM ENGINES, &c. 2843, 2878, 2886.

BOILERS AND THEIR FURNACES, &c., *None.*

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2838, 2873, 2874, 2897.

SHIPS AND BOATS, including their fittings, 2869, 2893.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2851, 2884, 2896.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2876.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2842, 2846, 2847, 2848, 2849, 2858, 2867, 2882, 2892, 2894.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. 2877.

LIGHTING, HEATING, AND VENTILATING, 2851, 2864, 2872, 2895, 2898.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2839, 2840, 2841, 2853, 2857, 2859, 2862, 2870, 2880, 2881, 2887, 2888, 2889, 2890, 2891.

METALS, including apparatus for their manufacture, 2845, 2850, 2868, 2898.

CHEMISTRY AND PHOTOGRAPHY, 2855, 2860, 2871.

ELECTRICAL APPARATUS, *None.*

WARFARE, 2852, 2856.

LETTER-PRESS PRINTING, &c. *None.*

MISCELLANEOUS, 2844, 2861, 2863, 2865, 2866, 2879, 2883, 2885.

2838. W. COOKE. *Improvements relating to carriages and vehicles, and the ventilation, the same being also applicable to other purposes.* Dated Nov. 12, 1861.

One portion of this invention consists in constructing a carriage of a form similar in outward appearance to what may be described as a double cab, but it is so constructed that, whilst from its lightness of structure it runs on two wheels, and may be drawn by one horse, four persons may ride in it with ease and safety. In the centre of the carriage the inventor places a suitable partition, in which may be a window to draw up and down, on each side of which partition he provides a seat. He also provides an entrance back and front. He provides sliding windows, with suitable apparatus for regulating the same, in position immediately over the axle-tree, and in the roof he provides a convenient seat for the driver, together with a box for his legs. The axle-tree he places higher than the seats of the carriage, and the shafts he securely fastens to the carriage. Another part of the invention consists in the adaptation to carriage or other windows of springs of wire gauze or other perforated material, so arranged as to form a series of folds extending and contracting at pleasure, for allowing the vitiated air to pass off at the same time that it admits pure air, and expels draughts or dust, the folds being so arranged that they rise and fall with the raising and lowering of the windows, and are closely folded at the top of the window or opening when not in action. *Patent abandoned.*

2839. A. V. NEWTON. *Improvements in the construction of dinner plates.* (A communication.) Dated Nov. 12, 1861.

This consists in forming round the main body of plates used for table purposes depressions or receptacles for articles of food, such as sauces, vegetables, or condiments, whereby they may be kept separate from each other, and within convenient reach in one and the same vessel. *Patent abandoned.*

2840. W. E. NEWTON. *Improvements in self-feeding inkstands.* (A communication.) Dated Nov. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2841. W. E. NEWTON. *Improvements in skates.* (A communication.) Dated Nov. 12, 1861.

This consists in a mode of attaching a skate to the boot or shoe, whereby it is rigidly held in its place by means of a longitudinal binding force exerted upon the boot or shoe. This result is effected by means of a movable clamp, either at the toe or at the heel, or both, which can be moved forward and backward, and can be held at any desired point, so as to be engaged with, or be disengaged from, the boot or shoe, the toe piece being so constructed, and so attached to the skate, as to slightly lap over the toe of the boot or shoe, and form a bearing for the foot to bear against, and prevent the skate from dropping at the toe. *Patent completed.*

2842. W. TONGUE. *Improvements in the manufacture of printed yarns, and in the application of certain fibrous materials to the manufacture of certain description of yarns and threads.* Dated Nov. 12, 1861.

We cannot here give space to the details of this invention. *Patent completed.*

2843. J. H. JOHNSON. *Improvements in the construction of steam or other vapour and water or other liquid tight joint.* (A communication.) Dated Nov. 12, 1861.

The liquid tight joint is produced by the combination of an open or split packing ring of copper, or other suitable metal, with a V or angular circular groove formed on one or both junction surfaces, or with angular or bevelled surfaces, on one or both faces of the joint, in such manner that the ring, which is open or in a slightly expanded state, when placed in or upon one of the angular surfaces or grooves, shall be closed, and forced into its proper place by the act of compressing the two parts of the joints together. *Patent completed.*

2844. L. F. DUVAL and L. A. BEAUDEL. *A new process of tanning.* Dated Nov. 12, 1861.

The main features of this invention will be gathered from the following claims:—The patentees claim the preparing of solutions of tannin or tannin liquors, in such a manner that, while being prepared, they are kept from all contact with atmospheric air, or with oxygen; and they especially claim the so preparing them, and, in addition thereto, subjecting them to the action of neutral gases, having neither alkaline nor acid properties, and exerting no prejudicial action on the tannin, or on the hides or skins, preferring to use for such purpose, under pressure or otherwise, hydrogen gas, or its gaseous compounds, or azote or nitrogen gas, or both hydrogen and azote. They also claim the application or combination of the arrangement known as "Woulfe's" apparatus to or with tanning pits or vessels, for bringing them into communication with each other. *Patent completed.*

2845. M. HENRY. *An improvement in, and composition for, treating iron and steel, and articles manufactured thereof.* (A communication.) Dated Nov. 12, 1861.

The patentee claims, first, the employment (in the manner described) of garlic, oil, and fat, when used together or conjointly, in the manufacture of compositions for treating iron and steel, and articles manufactured thereof. Second, the combination of garlic with oil and fat, for the manufacture of a composition for treating iron and steel, and articles manufactured thereof. Third, the treatment of iron and steel, and articles manufactured thereof, by immersing the same when in a red hot state (once, or oftener) in a composition consisting of garlic, fat, and oil, with or without other ingredients. *Patent completed.*

2846. T. L. Holt. *Making of paper from the cochlearia armoracia or horseradish.* Dated Nov. 13, 1861.

The inventor takes the stem of the leaf of the horseradish, and, using the same means as are used with hemp or flax stems, renders it into fibre by boiling or steeping. The ordinary means for making paper are subsequently adopted. *Patent abandoned.*

2847. T. B. Collingwood and A. Butterworth. *Improvements in throstle and doubling frames, for spinning and doubling fibrous materials.* Dated Nov. 13, 1861.

The object here is to remedy various defects in throstle and doubling frames, wholly or partly, by certain arrangements which will in many, if not all, cases catch the "snarl" of the thread when it begins to form, or catch the thread when broken, and prevent it from flying and breaking, or rendering other adjoining threads imperfect, and will at the same time prevent the material delivered by the rollers from "lapping" round them. The invention consists in making the upper end of the spindle project above the top of the flyer, and in forming thereon a flange or flanges, groove or grooves; or it consists in making a projection on the top or above the boss of the flyer, and in forming thereon a flange or flanges, groove or grooves, which will take hold of the thread when the "snarl" begins to form, or when it happens to break, so that the thread will accumulate on or about this said projection in the form of waste thread, till attended to by the "piecer." *Patent completed.*

2848. J. Hodgkinson and D. Greenhalgh. *Improvements in machinery or apparatus for preparing cotton, cot on waste, or other fibrous materials to be spun.* Dated Nov. 13, 1861.

This relates to certain descriptions of combing machines, and consists in collecting the fibrous material from the doffers of the machine upon a creeper of any material, or upon rollers. In connection with the creeper or collector there is a a funnel or trumpet through which the material passes, and, after passing betwixt rollers, comes out in a sliver, which can be entered into a coiler, wound on a bobbin, or passed into a head of drawing. The patentees also employ a horizontal shaft with clearers, which revolve underneath each brush and doffer, for the purpose of gathering up the short fibre and dust, and, consequently, improving the other material. *Patent completed.*

2849. W. H. Hammersley. *Improvements in machinery or apparatus for stretching, glossing, and finishing silk.* (A communication.) Dated Nov. 13, 1861.

This consists in placing a crosshead in the interior of a box or vessel, and causing it to work in suitable guides. To this crosshead hooks are attached, which carry a roller, and motion is given to the crosshead by a screw and nuts, the screw being turned either by hand or power. At the upper part of the vessel is placed another roller, which can slide in and out of the box when required. The silk to be stretched is placed on both the rollers, and, by turning the screw, it can be stretched to any extent desired. At the top of the box is attached a steam pipe, which extends to a well at the bottom, in order to prevent the condensed steam from wetting the silk. *Patent abandoned.*

2850. W. Clark. *The application of electricity in refining cast-iron for the purpose of converting it into wrought-iron or steel with or without the addition of other agents.* (A communication.) Dated Nov. 13, 1861.

This consists in subjecting the fluid iron to the action of an electric pile when the refining process may be quickly effected, especially if, at the same time, a reactive agent be used capable of removing the carbon, silicium, and other substances which injure the quality of the iron. *Patent completed.*

2851. E. C. Kemp. *Improvements in gas-lamps, glasses, and other fittings.* Dated Nov. 13, 1861.

This relates to gas-lamps, their glasses and tops, and consists, 1, in constructing the framework, or parts that retain the glass, of a hall lamp so that a single nut and screw at the top of each pillar or upright bar thereof serves to unite the upper frame, and the radial arms by which the lamp is supported and suspended from the centre; also in supporting them by a hook and eye from the gas-pipe in such way that the lamp can be unhooked at pleasure without interfering with the gas-duct. The invention also relates to gas and other lamps and their glasses and shades, and to the method of applying them to the fittings. These glasses or shades are generally supported by a triangular piece from the bottom, which throws a disagreeable shadow downwards. According to this invention the patentee supports them from the upper part, and for this purpose he makes the glass somewhat in the form of an inverted parabola or bell shape, with the large end uppermost; this is formed with a lip, which is inserted within a ring fixed horizontally at the termination, and on a level with the gas-arm of the lamp, or chandelier, or other fitting. The glass rests on two lugs within the ring, and is inserted from below, and fixed by a screw opposed to the two lugs. The gas is conducted by a small pipe from the arm, and descends within the parabolic shade to a suitable point, an opening is made in the bottom of the shade for the admission of air. He further applies a top or cover which harmonises with the contour, and completes the above form and arrangement of the shade. *Patent completed.*

2852. Sir W. G. Armstrong. *Improvements in the means of firing or igniting explosive projectiles.* Dated Nov. 13, 1861.

These improvements consist in a modification of the method of causing a shell to burst upon striking an object, as described in the specification of a patent granted to the present inventor, 10th April, 1858. In the specification of that patent the method in question is described as consisting of a weight or striker contained in a cylindrical case placed within the shell, and in which the striker was fixed by a pin which passed throught it, and which was cut or broken by the shock received by the projectile at the instant of being fired from the gun. The striker, being thus liberated by the act of firing, the gun would recede to the bottom of the case, and there remain until the velocity of the shell was checked by striking an object. The striker would then advance in the case, and cause a patch of detonating composition to be carried against a point by which it was ignited. In the modification, the subject of this invention, the pin for holding the striker is dispensed with, and the striker is secured by a metal hoop resting at the lower end on projections from the striker, and abutting at the upper end against the cover of the case. In this position the striker is held down and prevented from moving forward by the hoop; but when the gun is fired, the *vis inertia* of the hoop causes it to shear off the projections on the striker, which then becomes at liberty to run forward in the case when the shell strikes an object, and in so doing it ignites a patch of detonating composition by impact against the cover of the case, or a point projecting therefrom. *Patent abandoned.*

2853. L. Rolland. *An improved spring door shutter, with a moveable lever.* Dated Nov. 13, 1861.

This invention consists in setting a stiff metallic wire along the frame of doors, a little behind and parallel to the line of hinges, and extending about the whole height of the said doors; the upper end of the wire is pinched in a little socket fixed to the frame, while the lower end, running freely in another guiding socket, is pinched below by a small cap carrying a hinged lever, which lever can be brought at pleasure in a horizontal or vertical position; in the first case, bearing against the door, it shuts by the spring action of the wire; in the second case, standing up against the frame, it has no action on the door, which can remain open or be shut by hand. *Patent abandoned.*

2854. S. Procter. *Improvements in carriers or stackers, or apparatus for facilitating the stacking of straw, hay, or agricultural produce.* Dated Nov. 13, 1861.

This consists in the use of a tray or box without ends, which may be secured at one end to the end of the thrashing machine, or may be fixed on a carriage or framing, or otherwise; and it is preferred to make the tray or box in two parts, secured together by screws or pins passing through projections at the sides of the said tray or box, or it can be secured by other fastening. To this tray or box endless bands or belts are adapted, in such manner that, on motion being communicated thereto, the rollers and endless bands or belts will be put in motion, and will cause the endless bands or belts to travel upon the tray or box. The bands or belts being connected together by cross-pieces, termed "slats," secured thereto, the straw, hay, &c., coming from the thrashing machine will be carried forward to the other end of the apparatus, where the stack is in progress of formation. Motion is communicated to the bands or belts through rollers and pulleys, or wheels attached and provided with driving cords or straps, as also with a winch handle or crank. *Patent completed.*

2855. W. H. Balmain and J. Kean. *Improvements in the manufacture of flowers of sulphur, and roll and other forms of sulphur.* Dated Nov. 13, 1861.

This consists in supplying the pots with brimstone or sulphur in a liquid state, without admitting air or interrupting the process. *Patent completed.*

2856. J. Vaughan. *An improvement or improvements in the manufacture of bayonets, and in apparatus or machinery to be employed therein.* Dated Nov. 13, 1861.

Here the inventors stamp the blank for the blade in dies operating upon either a portion of the length, or the entire length, at one time. These dies are formed with sinkers suitable for producing the shape or sections required for the blank, so that when this blank is subsequently grooved, no trimming is required, and the dies remain uninjured, any surplus metal being forced out endways by the regulating dies, instead of forming a fin. *Patent abandoned.*

2857. C. E. Wilson. *A new article of female wearing apparel to be worn on the leg.* Dated Nov. 13, 1861.

This new article is designed to be worn above the boot, and to protect the leg between the ankle and the calf. The article consists of what the patentee terms a leglet, in contradistinction to gauntlet, and is made by preference of waterproof or glazed cloth, lined or not with flannel or other textile material; it is made to button round the leg or it is secured by elastic webbing, which unites the two ends or sides of the leglet. This new article not only keeps the leg warm, but protects it from dirt and wet at that part where mostly the dress comes in contact with it in walking. *Patent completed.*

2858. J. T. Townsend. *Improvements in harness to be used in the manufacture of all textile fabrics.* Dated Nov. 13, 1861.

This consists in forming the harness of metal wire. These wires are used to attach the mails to the bars between which they are stretched, instead of the cords usually employed. Instead of the lower bar, independent weights may be attached to each, as is sometimes used. The inventor makes the mails more elongated than usual, and points them more at the ends, to avoid their presenting a shoulder by reason of the smallness of the wire, whereby to prevent their offering an obstruction to their passage through the warp. *Patent abandoned.*

2859. F. Conry. *An improved stock for brooms.* Dated Nov. 13, 1861.

The object of this invention is to obtain the equivalent of two separate brooms upon one stick or handle, and the invention consists in forming the stock with a head and two sides as hereafter explained. A hole is made in the stock for the reception of the stick or handle; the two sides are continued down at angles, approach or meet at the bottom of the broom, and carry bass, hair, or other fibre; one side may be filled with bass, and the other with hair, or they may both be filled with similar or different materials suitable for brooms. *Patent completed.*

2860. R. A. Brooman. *Improvements in albums for containing photographic and other pictures.* (A communication.) Dated Nov. 13, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2861. H. Bird. *Improvements applicable to corks and other stoppers for bottles and other vessels containing poison.* Dated Nov. 13, 1861.

The object here is to prevent the accidental use, or inadvertent withdrawal, of poison contained in bottles or other vessels to which the invention is applied, and the invention consists in forming on or applying to the tops of corks or other stoppers a number of horizontal short points, radiating from, and beyond the upper edge of, the cork or other stopper, so that the cork or other stopper cannot be casually withdrawn from the bottle or other vessel in which it is fixed by hand, without the operator feeling one or more of the sharp points. *Patent completed.*

2862. A. E. Carter and T. Hack. *Improvements in screw cocks.* Dated Nov. 13, 1861.

Here the patentees form a water-tight joint between the upper surface of the thrust collar on the stem of the screw and the under side of the cover of the valve box, so that, when the valve is shut down, and the upper surface of the thrust collar pressed strongly against the under surface of the cover, the escape of water or fluid around the stem of the screw is prevented, even when the packing is removed; and as the water-tight joint, in order to be of any service, must be so constructed as to shut closely, not only when first made but even after the parts have been long exposed to the corrosive action of the water or fluid, they let a ring of brass or other suitable metal into the cover of the valve box around the hole for the passage of the stem of the screw, and turn the same by preference concave. The thrust collar on the screw (which it is preferred to be of brass) is turned convex on its upper surface, and it is ground into the ring let into the cover, as is ordinarily the practice in making valve joints. By this arrangement it is obvious that the packing may be removed whilst the valve is still exposed to the pressure of the water or fluid, it being necessary only to shut the valve closely. *Patent completed.*

2863. G. T. Bousfield. *Improvements in the manufacture of soap.* (A communication.) Dated Nov. 13, 1861.

This consists, mainly, in saponifying the fatty acids generally, and more particularly the red oil of commerce, by the use of sal soda, or other crystallized carbonate of soda reduced to a fluid state by fusion in its own water of crystallization, and finishing the resulting soap paste, as described. Also in manufacturing soap from the above-mentioned materials, and finishing the resulting soap paste by treating it with liquid quartz, or with the aqueous solution of any of the chemical or commercial varieties and forms of silicates of soda or potassa, as described. *Patent completed.*

2864. J. Leslie. *Improvements in the manufacture of gas.* Dated Nov. 13, 1861.

Here, in order to manufacture gas more advantageously from hydro-carbon fluids, the hydro-carbon fluid is caused to flow or drop down a tube or series of tubes, by preference in an upright position, within an outer vessel or retort, which is heated externally. *Patent abandoned.*

2865. H. R. Faulkner and J. Manley. *Improvements in apparatus for facilitating the cleansing of sewers and other water courses or ways.* Dated Nov. 13, 1861.

This consists of a bar or axis of wood or iron, having thereon numerous tines, or blades, or stivers, which are fixed round the circumference of the bar or axis in such a position as to stand in the place of the thread of a screw, the bar forming the centre or shaft of such screw; thus placed tines, or blades, or stivers are actually detached portions of the thread of the screw. The two ends of the shaft or axis are furnished with swivels, and by the act of drawing or moving the shaft or axis longitudinally through water or mud, such shaft or axis will revolve or rotate together with the tines, or blades, or stivers thereon, so as to agitate the mud and matters which are below the water, and beat up and internally mix such mud and matters as are in the sewers, rivers, &c. *Patent completed.*

2866. A. C. Lipsett. *Improvements in apparatus for heating or boiling fluids for domestic or other purposes.* Dated Nov. 14, 1861.

Here the inventor uses a vessel of any desired dimensions and formed of a conical shape, tapering smaller towards the bottom, at which part it is provided with a watertight aperture employed for fitting the vessel upon a tube fixed to a circular concave saucer or plate, so that the bottom of the vessel does not touch the saucer, but allows it, as well as the conical surface of the vessel, to be exposed to the flame arising from the ignition of methylated spirit of wine, or other suitable spirit placed in the saucer. *Patent abandoned.*

2867. G. Bridge. *Improvements in machinery or apparatus for preparing cotton and other fibrous materials to be spun.* Dated Nov. 14, 1861.

Here the inventor causes a current of air to come in contact with the cotton or fibrous material just at the point where the feed rollers nip the machine as it proceeds into the blowing machine or beater. The current of air coming in contact with the material at this position carries off the dirt or refuse that is not held between the rollers without any blowing away or waste of the fibres. *Patent abandoned.*

2868. W. Heat. *An improved instrument for cutting pipes and bars of metal.* Dated Nov. 14, 1861.

This consists of a frame with an opening in it, through which the pipe or bar to be cut is held; the pipe or bar is held in the frame between rollers, and at one side of the frame is a screwed boss for the bush of the handle, which is made with a spindle acting on a sliding stud, to which one pair of the rollers is connected, and at the other side of the frame is the cutting tool, which is acted upon by the spindle of the other handle, the bush of which is also screwed on a boss. The instrument is turned round by the handles above referred to, in order to cause the cutter to act on the pipe or bar. *Patent abandoned.*

2869. M. Wigzell. *Improvements in machinery or apparatus to be used in moulding and casting twisted nails, bolts and screws, for sheathing vessels, shipbuilding, and other purposes.* Dated Nov. 14, 1861.

This consists of a plate or plates fitted with any number of nuts, through which screws of the required pitch work; on the ends of the said screws are attached the screws or twisted form of nails forming the patterns of the articles to be made, which patterns, by being made to descend, screw themselves into the sand, or other material used instead of sand, and produce the required form or mould. The plate or frame containing the screws is made to rise or fall by a screw or lever, by hand or any known motive power; and this plate or frame, when raised, carries with it the screws and patterns of the nails or other articles to be made, and causes them to twist or unscrew themselves out of the mould, the nuts through which the screws work being fixed and arranged on a suitable framework or stand. *Patent completed.*

2870. R. Heath. *An improvement in umbrellas and parasols.* Dated Nov. 14, 1861.

In order to connect the ribs and stretchers of umbrellas and parasols together, an eye is attached to each of the ribs by brazing, soldering, or otherwise; this eye is made of bent wire or other suitable material, which, being shaped into the proper form, is passed through the hole or holes at the end of a stretcher, and then fixed to a rib of an umbrella or parasol. *Patent completed.*

2871. F. R. Hughes and T. Richardson. *Improvements in treating certain natural saline compounds to fit them for agricultural use, and in order to obtain potash and other salts.* Dated Nov. 14, 1861.

This consists in treating those material compounds of alkaline and other salts, which are found at Strassforth, in the duchy of Magdeburg, and in other places, so that they may be used for manuring land, and to separte the potash and other salts therefrom. These natural compounds contain a deliquiscent salt (muriate of magnesia), which the inventor separates by steeping them in a small quantity of cold water, by which the greater part of this salt is dissolved out; or they heat these natural compounds with or without steam, so as to decompose the greater part of the muriate of magnesia; and the residual mixture of salts from either process, having by these means lost its deliquiscent properties, is suitable for application as a manure. The mode of separating the potash may be varied. *Patent abandoned.*

2872. G. Hawksley. *Improvements in apparatus for sounding alarums and actuating ventilators.* Dated Nov. 14, 1861.

This consists in means for sounding alarums and actuating ventilators when the temperature of an apartment is increased beyond that at which the apparatus is set to go. This object is effected by means of strips of metal (by preference zinc) which will expand freely by heat, in combination with certain levers. *Patent abandoned.*

2873. W. Leopard. *Improvements in railway break apparatus.* Dated Nov. 14, 1861.

We cannot here devote space to the details of this invention. *Patent abandoned.*

2874. C. H. Murahain. *Improvements in ventilators for railway and other carriages and for other similar purposes.* Dated Nov. 15, 1861.

This invention is carried as follows:—At the top of the aperture, for the window sash, and behind the grooves in which the sash slides, the inventor places one or more strips of wire or silk gauze, jointed together, so that they can be folded or opened out, the top strip being held by pivots working in bearings fixed to the frame. The bottom strip of gauze is mounted with a bevilled strip of wood or other material, to which the top of the sash is made to correspond, and the strips are made to unfold or expand by weights or pulleys. There are details, which we cannot here give space to. *Patent abandoned.*

2875. J. Nixon. *Improvements in apparatus for ventilating coal or other mines or underground excavation.* Dated Nov. 14, 1861.

This consists in the arrangement of rectilinear ventilating pistons so that they can work in correspondingly formed air chambers in a horizontal manner. These pistons are supported on rollers or wheels which travel on a railway, tram road, or other metallic surface. The pistons are attached to the motive power by piston and connecting rods in the usual way. *Patent completed.*

2876. J. Spratt. *Improvements in the preparation of food for hogs, dogs, cats, and poultry, and in apparatus for the same.* Dated Nov. 14, 1861.

The patentee claims mixing and combining animal matters such as greaves, dregs or scraps, being the residue from boiling down animals or portions thereof, or of rough fat from tallow chandlers or fat melters, or of butchers' and other trimmings, with farinaceous matters, as described, for the purpose of feeding hogs, dogs, cats, and poultry. *Patent completed.*

2877. E. Loomes. *Improved machinery for moulding bricks, tiles, and other like articles.* Dated Nov. 15, 1861.

This consists in adapting to the lower end of the pug mill shaft one, two, or more eccentrics, cams, wipers, &c., in combination with moveable stops, against which the clay or substance to be moulded is pressed by the cams or wipers as they move round. By that means the clay is squeezed between the curved surfaces of the wipers and the stops, and will thereby be forced out of the mill through the apertures provided for the purpose, and will be pressed into or through moulds or dies. *Patent completed.*

2878. W. E. Newton. *Improvements in steam-engine governors.* (A communication.) Dated Nov. 15, 1861.

This consists in so arranging and constructing the parts of governors that the centrifugal and centripetal forces which are brought into action in the ball governor may be so equally balanced that the governor shall be made to act with the greatest possible accuracy, and be highly sensitive to any chang[illegible] speed in the engine. *Patent completed.*

2879. L. A. Sou[illegible] [illegible]ments in the mode of preparing and subs[illegible] [illegible]des or skins.* Dated Nov. 15, 1861.

This consists [illegible] apparatus within [illegible] the skins o[illegible] [illegible]pon are stretched [illegible]ended, and [illegible] motion is produced in the tanning solution which facilitates and accelerates the operation. *Patent abandoned.*

2880. W. Stanten. *Improvements in the manufacture of brushes and in preparing certain vegetable fibres for such and other uses.* Dated Nov. 15, 1861.

This consists in applying to such manufacture the vegetable fibres of the *Arengo Saccharifera.* It is from the leaves that these fibres are obtained, and they are collected after the other portions of the leaves have become dry, and have more or less shelled off from the fibres, leaving the fibres for the most part separated from each other. *Patent abandoned.*

2881. J. Grist. *Improvements in the mode or method of uniting and otherwise connecting surfaces of leather, wood, and other substances, and the apparatus connected therewith for manufacturing the same.* Dated Nov. 16, 1861.

This consists in making pegs or nails of wood, bone, metal, &c., with a sharp point, and being barbed near the point to hold securely. The head or after end is enlarged from the body of the peg in regular, tapered, or curved lines. *Patent abandoned.*

2882. J. Booth, T. W. Chambers, and J. Chambers. *Improvements in looms for weaving.* Dated Nov. 16, 1861.

The patentees claim, 1. in the taking-up motion, the employment of curved or straight inclines, acting in combination with excentrics. 2. In the letting-off motion umaxular warp beam and rail, for maintaining a uniform tension of the warp at all diameters of the warp on the beam, without the moving of the weights. 3. The prolongation of the connecting rod or crank arm and the bracket, terminating with a downward hook, and also the bracket attached to the loom side, for making the reed fast and loose as required. 4. The use of an arm jointed to the front part of each end frame of the loom, and projecting towards the back, and also causing the rotary motion of the tapped shaft to turn in the same direction as the crank shaft, for bringing the picking stick forward, and propelling the shuttle by a downward stroke of the packing tappet. 5. The concave and convex wheels for causing the healds to have a temporary suspension of motion during the traverse of the shuttle. *Patent completed.*

2883. J. C. Goodall, and J. Beale. *Improvements in machinery for folding envelopes.* Dated Nov. 16, 1861.

Here a revolving disc or table is used, in which four recesses are formed, each of the size of an envelope, and each recess has four guides or pins at the four angles, to facilitate the reception and correct placing of the pieces of paper cut to the proper size and form for an envelope. This table or disc is caused to make one fourth of a rotation at each action of the machine, and provision is made for correctly holding the table or disc after each partial revolution. The machinery is so arranged and combined that the apparatus for embossing the seal flap, for applying gum or cement to the other flaps, for creasing the paper, and for pressing down the flaps, are all carried, and act simultaneously, by means of a lever. *Patent completed.*

2884. M. Gibson. *Improvements in reaping and mowing machines.* Dated Nov. 16, 1861.

Here, in order to reduce the friction between the knife bar and the finger bar, and to prevent them from becoming choked, the patentee forms the knife bar with projections on the under side; these projections are received in grooves formed across the necks of the fingers; the bottom of the groove across each of the fingers is made to incline upwards from each of its ends, so that each projection only rests upon an edge across the centre of the groove in which it is received. The back of the knife bar has also projections formed on it behind the centre of each knife; these projections work against projections on the edge of the finger bar. As the knife bar is moved to and fro, the projections on its under side remove at each stroke from the necks of the fingers any matter that might otherwise lodge and obstruct the motion of the knife bar; the projections behind the knife bar prevent, in a similar way, any matter from lodging between the edges of the knife bar and finger bar. When the knives are attached to the under side of the knife bar, the knives may be formed with projections on their under side, in place of the projections being formed on the bar. *Patent completed.*

2885. E. D'Estanove. *An instrument for drawing teeth without danger, as the extraction is made without any version, any pressure on the gum, or action whatever with the neighbouring teeth, and, in a word, the said instrument not resting on any part of the mouth.* Dated Nov. 16, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2886. D. Stewart. *Improvements in hydraulic cotton presses worked by steam.* Dated Nov. 16, 1861.

This consists, 1, in the combination and management of a small steam engine and set of pumps in one with the press, which steam engine and pumps are adapted alone for the individual press with which they are combined. 2. In the application of a receiver or accumulating vessel, into which the pumps throw the water and retain it under a pressure while the bale of cotton is being lashed or secured and removed from the press. *Patent completed.*

2887. R. T. Worton. *Improvements in pianofortes.* Dated Nov. 16, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2888. J. Elsa and T. Gouvary. *An improved washing apparatus.* Dated Nov. 16, 1861.

This consists of an oblong frame (of wood, or other suitable material), the bottom whereof is open, and the lower ends of the sides of the frame are either straight, or are inclined inwards, the inclination being such that the frame will be firmly on the bottom and sides of a puncheon, or washing tub, or vessel. On the sides of the frame, inside thereof, are two grooves which receive the edge of a sheet of zinc, or other suitable metal, which is corrugated in the direction of its width, having corrugations either of an uniform character or varying in their width or depth. The corrugated sheet is somewhat raised in the centre, [illegible] on a strip of wood or other material which is placed [illegible] between the sides of the frame, and stands a little [illegible] the slots in the sides of the frame; the ends of the strip rest upon the pieces of wood or other material stretching from side to side of the frame. From a little below the top piece, and at a short distance from the top thereof, is a piece of wood or other material which extends to the top of the frame, and connects the top end and sides together, and also forms a surface for the water to run down when the apparatus is in use. *Patent completed.*

2889. W. Naish. *Improvements in numnahs or saddle cloths.* Dated Nov. 16, 1861.

Here the inventor proposes cutting off the saddle cloth of the desired shape from a sheet of felt or felted cloth, and recovering the same with any suitable woollen cloth. *Patent abandoned.*

2890. J. M. Clements. *Improvements in the making or manufacturing of certain parts of garments for either sex, likewise in the manner of preparing the same for sale, also an improved button to be attached to garments without sewing, and in the machines for creasing, folding, and performing the various kinds of stitching, sewing and button-hole working necessary in making parts of the same, and which said improved machines are also applicable for performing such kind of work generally.* Dated Nov. [illegible] 1861.

We cannot here devote space to the details of this invention. *Patent abandoned.*

2891. J. Hawkins. *Certain improvements in bits for riding and driving.* Dated Nov. 18, 1861.

This consists in forming a slot in each cheek of the bit intended to be made, and into these slots the ends of the mouth pieces fit, the outer ends of which are enlarged so as to prevent the cheeks separating from the mouth piece, but allow the mouth to freely revolve and work up and down in the slots, but when the mouth piece has an eccentric projection on one side for pressing on the horse's tongue during the time of holding in or restraining the horse, the mouth piece passes to the end of the slot, and the eccentric or projecting portion of it, which before was parallel with the length way of the cheeks, will now come at right angles with them, causing pressure more or less on the tongue of the horse; but when the shank is relieved from the mouth of the horse by slackening the rein or bridle, the mouth piece will return by the action of the horse's mouth. *Patent completed.*

2892. W. and E. Cliff. *Improvements in the manufacture of lace.* Dated Nov. 18, 1861.

This consists in the production of a peculiar mesh for the gathering of figures in lace made in lace machines, the mesh is formed of one or more warp threads, and by the combined use of warp threads and bobbin threads. *Patent abandoned.*

2893. P. Andre, J. P. Pline-Faurie, and J. P. [illegible] *Machinery or apparatus for preparing or manufacturing fuel.* Dated Nov. 18, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2894. P. C. Partow. *Improvements in machinery or apparatus for raising and finishing fabrics.* (A communication.) Dated Nov. 18, 1861.

Here the patentee uses two or more cylinders covered with teazles, brushes, cards, &c., which receive a rotary motion, so that half of them turn in the opposite direction to the other half, and have at the same time a reciprocating motion transversely to the motion of the fabric, or in the direction of the weft of the fabric. As the fabric is delivered from the machine, it passes over or in contact with the cylinders in a direction parallel with their axes, and is thereby raised and stretched from the middle to the edges, or from one selvage to the other. There are adjustable guide rollers for placing the fabric in or out of contact with the cylinders. *Patent completed.*

2895. M. D. Rogers. *An improved chain cable.* Dated Nov. 18, 1861.

This is designed to assist the riding of ships at anchor, for feiting the cable, and securing every link thereof when heaving in the cable. The patentee proposes to effect this by a metal frame fixed to the ship's deck, near the hawse hole; this metal frame has a solid tongue or pawl hinged thereto from above, and the under side of the pawl or tongue is hollowed out to the form of the links of the cable; the bottom of the frame is also grooved for the links of the cable to slide in. The said pawl or tongue may be raised by a handle, so as to allow the cable to pass freely, but upon lowering the said pawl or tongue, the cable can be securely held at any moment, and is as easily and as quickly released. *Patent completed.*

2896. R. A. Brooman. *Improvements in reaping and mowing machines.* (A communication.) Dated Nov. [illegible] 1861.

This invention will be described and illustrated in an early number of this journal. *Patent completed.*

2897. C. M. Poillery. *An improved mode of constructing and fixing the rails of railways.* Dated Nov. 18, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2898. G. Prodon, and M. G. Prodon. *Improvements in means or apparatus for rolling metals.* Dated Nov. 16, 1861.

This relates to a combination of means by which facility is obtained for the production of various forms in relief. The patentees form the extended figures or forms on the surface of rings which are applied to an axis, so as to be held thereon by screw nuts aided by grooves and keys or ribs. For change of pattern it is necessary only to remove one pair of rings, replacing them by others. The metal to have form or figure given to it is conducted correctly to its position on the surface of the rollers by guides capable of adjustment. The bearings of the upper rolls are supported or operated by screws geared so as to be operated together, and thereby insure uniformity of pressure. *Patent completed.*

2899. A. J. Mundella, and W. Onion. *Improvements in machinery or apparatus for the manufacture of looped fabrics.* Dated Nov. 18, 1861.

The specification of this invention comprises much detail, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2900. G. PARRY. *Improvements in the manufacture of iron and steel.* Dated Nov. 18, 1861.

This consists in introducing wrought iron (which has been puddled), with coke or other fuel, and suitable fluxes, into a blast furnace, similar in form to that ordinarily used for melting pig iron, but so arranged with respect to the tuyers as to ensure the maintenance of a much higher temperature in the furnace than is required for merely melting the iron. When the iron is thus carburetted he runs it out from the furnace into any suitable form, and submits it to the puddling process. *Patent completed.*

2901. L. SMITH and M. SMITH. *Improvements in raising liquids, and in apparatus connected therewith, parts of which are applicable to improving the quality of fermented liquors.* Dated Nov. 19, 1861.

This consists essentially in forcing air into the cask or other vessel containing the liquid to be raised, which air displaces the liquid and occupies the space. *Patent completed.*

2902. J. HEMINGWAY. *Improvements in machinery or apparatus to be used in the working, "winning," or mining, of coal, clay, shale, and other minerals or earthy matters.* Dated Nov. 19, 1861.

This consists, 1, of a frame in which is or are mounted a revolving circular saw or saws, or cutters, or a revolving wheel or wheels, or disc or discs, to which are attached saws or other cutters, either toothed or edged, and either separately or combined, which are caused to revolve simultaneously, either by manual labour or steam power. This machine may be arranged so as to make horizontal, perpendicular, or oblique cuttings, and is to be used for cutting any square or other formed block ot coal or other matter which it is desired to "win" or get so as to partially detach the same from the general mass, and thus render its complete separation therefrom by the ordinary means much easier than heretofore. *Patent completed.*

2903. T. REDWOOD. *Improvements in the manufacture of starch, and of a vegetable sizing powder.* Dated Nov. 19, 1861.

This relates, 1, to the manufacture of starch from rice by the use of a caustic alkaline solution, and consists in adding oxide of zinc to the solution of caustic soda, or other alkaline solution, in which the rice is macerated. It relates also to the treatment of starch, so as to impart properties to it which increase its value as a material to be used in sizing paper, &c. This part of the invention consists in adding to the starch an acid solution of chloride of zinc, then drying the starch with the solution which has been added to it, and lastly, treating the dried starch in an oven at a temperature of about 240° Fahrenheit. *Patent completed.*

2904. J. LEE. *Improvements in the construction of the wheels of traction engines, and in the mode of adaptation to such engines.* Dated Nov. 19. 1861.

This consists, 1, in adapting transverse bars of metal to the felloes of the wheels of traction engines to ensure greater hold of the said wheels on the ground than heretofore. 2. In connecting together at will two of such said wheels placed at opposite sides of the engine, or only connecting one of the said wheels with the spur wheel of the engine, so as to be driven thereby. 3. In adapting a broad wheel to the fire-box end of the boiler of a traction engine. *Patent abandoned.*

2905. J. TAYLOR and T. A HEPWORTH. *Improvements in equilibrium lubricators for steam cylinders, valve-boxes, and other similar purposes.* Dated Nov. 19, 1861.

This consists in fitting in the interior of the cup or vessel containing the tallow or lubricating matter a spindle having two valves, fast or otherwise, one at the top and the other at the bottom of the vessel, and fitting seatings in such manner that, when the spindle is pressed downwards, the upper valve is opened, and allows the lubricating matter to enter the cup or vessel, and at the same time close the lower valve, and prevent any admission of steam; and when the spindle is raised, by a spring or other means, the upper valve is closed, and the lower valve opened, which admits steam to the top of the lubricating matter, so as to form an equilibrium and allow the said matter to fall of its own gravity into the steam cylinders, valve-box, or other vessel to which it is applied. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated April 8, 1862.

1001. H. A. Holden, Birmingham, merchant, and C. Weekes, Carmarthen, C.E. Improvements in apparatus used in drawing water or other fluids from cisterns, tanks, or other vessels.

Dated April 16, 1862.

1110. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in machinery or apparatus for cutting the teeth of wheels, racks, or segments. (A communication.)

Dated April 19, 1862.

1143. W. Munn, Borrowstonnness, Linlithgow, N.B., engineer, and D. Ballantine, jun., ironfounder. Improvements in mills for grinding.

Dated April 21, 1862.

1163. A. Dixon, Birmingham, engineer. Improvements in knife and fork cleaning machines.

Dated April 23, 1862.

1187. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in looms for manufacturing tufted pile fabrics, and in the mode of operating such looms. (A communication.)

Dated April 25, 1862.

1211. P. R. Drummond, Perth. A revolving rake for lifting objects from the ground.

Dated April 30, 1862.

1264. E. Moore, Tewkesbury. Improvements in the manufacture of dress shirts and dresses.

1265. A. Travis, foreman, and B. Travis, mechanic, Dukinfield. Improvements in engines for carding cotton and other fibrous materials.

1267. J. Harrington, Birmingham, photographic artist, and T. Perkins, lime merchant. An improvement or improvements in mounting photographic portraits for visiting cards and in mounting photographs in general.

1269. G. Davies, 1 Serle-street, Lincoln's-inn, C.E. Improvements in the manufacture of nails, screws, and other analagous articles in malleable cast-iron. (A communication.)

1271. J. Maiden, Waterloo, near Ashton-under-Lyne, smith. Improvements in safety lamps.

1273. T. Piatti, 76 Rue St. Louis au Batignolles, Paris. Improvements in the propulsion of ships and other vessels, and in the means and apparatus employed for this purpose.

1275. J. Oxley, Garden-street, Sheffield, manufacturer. Improvements in apparatus for cutting and chopping bread and other substances.

1277. J. M. Carter, Monmouth. Improvements in harness and shafts of carriages.

1279. W. Staufen, George-street, Portman-square. A new material to be used in the manufacture of brushes. and also applicable to the purposes for which bristles, horse-hair, and human hair are now used.

1281. J. M. Napier, York-road, Lambeth. Improvements in machinery for manufacturing projectiles.

1283. H. F. Broadwood, Great Pulteney-street, pianoforte maker. Improvements in the construction of pianofortes.

1285. W. E. Newton, 66 Chancery-lane, C.E. Improvements in lamps. (A communication.)

Dated May 1, 1862.

1287. J. Swallow, Heckmondwike, manufacturer, and J. Allinson, weaver. Improvements in the manufacture of carpet fabrics.

1289. C. P. A. Douchain, St. Cloud, France, engineer. Improvements in apparatus for letting in or shutting off water or other liquids.

Dated May 2, 1862.

1291. W. and T. Huntington, Victoria Mills, Liverpool, millers. Improvements in the machinery for the manufacture of bread.

1292. H. Kohn, 29 Unter den Linden, Berlin, merchant tailor. A new method of making any kind of stuffs, textures, or fabrics waterproof.

1293. W. Bodden and W. Mercer, Hargreaves Spindle Works, Oldham. Improvements in certain parts of machinery for slubbing and roving cotton and other fibrous substances.

1295. R. Walker, Glasgow, distiller, Improvements in malting and in apparatus therefor.

1297. O. C. Evans, 20 Church-street, Old Kent-road. An abdominal truss, intended for the more perfect support and cure of hernia.

1301. M. Paul, Dumbarton, N.B., engineer. Improvements in windlasses and capstans, or ships' winding apparatus.

1303. H. Welch, Millwall, carpenter. Improvements in securing or attaching armour plates on or to ships or vessels.

Dated May 3, 1862.

1305. W. Mossman, 1 Cleveland-terrace, Gloucester-road, Islington, manufacturing stationer. Improvements in the manufacture of bonnets, hats, or coverings for the head.

1309. E. Omerod, Manchester, engineer, and C. Schiele, engineer. Improvements in machinery or apparatus for cutting or dressing stones, which are also applicable for hammering, crushing, or otherwise reducing metals and other materials.

1311. J. M. Herdevin and J. A. Julien, ingenieurs, 13 Rue Gaillon, Paris, France. Improvements in sluice cocks.

1313. J. M. Heppel, 34 Great George-street, Westminster, C.E. Improvements in the construction of the permanent way of railways.

1315. W. Black, Wood-street, Northampton. Improvements in lottery and ballot boxes.

1317. M. Henry, 84 Fleet-street. Improvements in the process of and apparatus for preparing materials for the manufacture of paper, and in obtaining products from agents used in the said process, part of the invention being also applicable to apparatus for washing. (A communication.)

1319. S. Merolla, Lago Castello, 75, Naples. Improvements in fire-arms.

1321. J. and T. Mellodew, Moorside Mills, Oldham, manufacturers, and C. W. Kesselmeyer, Manchester, warehouseman. Improvements in looms for weaving.

1323. J. Heyworth, Shawforth, Rochdale, overlooker. Improvements in looms for weaving.

Dated May 5, 1862.

1325. A. Williams, New Windsor, Berks, schoolmaster. The construction of a backed form or seat capable of being converted into a level table with seat or a desk either level or sloping, or at any angle.

1327. L. G. Perreaux, Paris, engineer. Certain improvements in clocks or machines for keeping time.

1331. T. P. R. Brindley, 2 Leonard-square, Finsbury. Improvements in travelling and other flasks, decanters, bottles and other necked vessels.

1334. J. Victor, Wadebridge, Cornwall, Hydraulic engineer, J. Polglase, Bodmin, mine agent, and W. Rounsevell, St. Breock, near Wadebridge, carpenter. Improvements in the manufacture of safety fuses for mining and other purposes.

1335. R. Burley, Glasgow, carpenter. Improved arrangements for using ordnance under water, and in part applicable otherwise.

1337. J. Roscoe, Bell-lane, Leicester. An improved lubricator for steam engines.

1339. E. B. Wilson, 5 Parliament-street, Westminster, engineer. An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel.

1341. J. Adcock, Marlborough-road, Dalston, mechanician. Improved apparatus for measuring and indicating distances travelled by wheel carriages.

Dated May 6, 1862.

1343. T. Cabourg, 333 Rue St. Martin, Paris, boot and shoe manufacturer. Improvements in machines for the purpose of uniting together, by means of screws, leather used in the manufacture of boots and shoes, and other articles composed of two or more pieces of leather.

1345. A. Morel, Roubaix, France, manufacturer. Improvements in heckling machines.

1346. G. Borthwick, Bedford, near Leigh, book-keeper. Certain improvements in the construction of ships, boats, and rafts.

1347. P. Chenailllier, Paris, France, gentleman. Improvements in apparatus for concentrating liquids, or for condensing alcoholic or other vapours.

1349. W. and J. Richard, Edinburgh, type-founders. Improvements in the manufacture of printing types, spaces, and quadrats.

1351. W. Greaves, 11 Portland-street, Poland-street, Soho, saddle tree maker. Improvements in safety stirrup bars.

1353. W. Clark, 53 Chancery-lane, engineer. An improved buckle or fastening. (A communication.)

1355. J. E. Ransome, W. Copping, and L. Lansdell, Ipswich. Improvements in harrows.

Dated May 7, 1862.

1356. W. E. Nethersole, Swansea, superintendent. Improvements in parts of railway trucks and waggons, parts of which are applicable to railway carriages.

1359. C. V. F. De Bervilla, 72 Rue Blancha, Paris. An improved safety coupling bar for locomotives and other railway carriages.

1363. C. Clark, 361 City-road, E.C. An improved cigar tube.

1365. J. Johnson, cordwainer, and A. Chapman, gentleman, Leatherhead. Improvements in apparatus for preventing collisions on railways.

1367. R. A. Brooman, 166 Fleet-street, patent agent Improvements in swings. (A communication.)

1369. G. T. Bousfield, Loughborough-park, Brixton. Improvements in applying steam power to tilling land by means of a digging locomotive. (A communication.)

1371. W. Gossage, Widnes, Lancaster, chemist. Certain improved apparatus to be used in the manufacture of soap.

1373. J. McCann, Dublin, gentleman. Improvements in the mode of, and apparatus for, drying, cooling, and cleaning grain.

Dated May 8, 1862.

1375. W. P. Gaulton, engineer, and Major Booth, calenderer and finisher, Manchester. Improvements in apparatus or machinery for damping and steaming fabrics, part of which improvements are applicable for distributing fluids for other purposes.

1379. J. Fowler, Leeds, engineer, and J. King, Chadshunt, Warwickshire, farmer. Improvements in apparatus for tilling land by steam power.

1381. C. Lungley, Deptford, shipbuilder. Improvements in apparatus for manœuvring ships and vessels.

1383. A. P. Price, 47 Lincoln's-inn-fields, gentleman. Improvements in straps or bands for securing articles; parcels, or luggage.

1385. L. De la Peyrouse, 13 Panton-square, manufacturer. Improvements in treating neutral and acid fatty or oily substances, resins, and resinous substances, and compounds or products containing paraffine.

Dated May 9, 1862.

1393. J. F. Bland, Dorset-square, captain in H.M. 76th Regiment of Foot. An improved method of and apparatus for signalling between targets and shooters.

1395. J. Oxley, Frome, brewers' engineer. Improvements in apparatus for facilitating the processes of mashing and sparging in breweries and distilleries.

1397. N. Symons, 6 Cambridge-street, St. Pancras, ironfounder. Improvements of all kinds of wheels, framework, girders, columns, and stancheons, blades of blowing fans, and paddle-wheels for steam vessels.

1399. F. J. Bolton, Bolton-row, May-fair, captain in H.M. 12th Regiment of Foot. An improved mode of, and apparatus for, displaying the lights in lighthouses.

Dated May 10, 1862.

1400. G. C. Haseler, 19 Victoria-street, Birmingham, manufacturing jeweller. Improvements in the manufacture of lockets, and of a new application of Parkesine as a substitute for glass in the construction of lockets and other articles of jewellery.

1401. J. G. Willans, 2 Clarence-place, Belfast. Improvements in the treatment of the product from iron blast furnaces (whether moulded or otherwise), usually termed pig, or cast iron, or castings.

1403. W. Clark, 53 Chancery-lane, 53 Chancery-lane, engineer. The application of a vegetable fibre alone or in combination with other matters in the manufacture of felted and other fabrics, also as a substitute for flock or powdered wool, and as a material for padding or stuffing, and for other useful purposes. (A communication.)

1405. R. Moore, Cannon-street West, engineer. Improvements in the structure and appliances of ships and other vessels.

1407. R. Willoughby, Mildmay-road. Improved apparatus for exhibiting and giving rotatory and traversing motion to placards, advertisements, scenes, and other objects.

1409. J. House, Market Lavington, Wilts, engineer. Improvements in machinery or apparatus for crushing or reducing substances.

1411. E. Kolbenheyer, Vienna, Austria. An improved apparatus for making ices and cold beverages.

1413. W. Clark, 53 Chancery-lane, engineer. Improvements in lamps, and in apparatus for filling lamps with oil or fluid to be consumed. (A communication.)

Dated May 12, 1862.

1415. H. Walker, Gresham-street, needle manufacturer. Improvements in making handles for crochet needles, pencils, penholders, and other articles.

Digitized by Google

1417. G. Fuhrmann, 16 Passage des Petites Ecuries, Paris, merchant. Improvements in melting and boring cast steel barrels, applicable to fire-arms and pieces of ordnance. (A communication.)

1419. J. B. Pope, West Riding and Haigh Moor Collieries, near Leeds, coal owner. Improvements in apparatus for lowering and loading coals, minerals or other substances.

1421. H. S. Firman, 73 Great Suffolk-street, Southwark. Improvements in apparatus for washing and cleansing textile fabrics or raw materials, and for forcing fluids or moisture from the same. (A communication.)

1423. H. Bayley, cotton manufacturer, L. Newton, cotton spinner, Oldham, J. Greaves, manager, Staleybridge. Improvements in machinery for turning, boring, cutting, shaping, and reducing wood and other substances applicable for the manufacture of various articles.

1425. W. N. Hutchinson, Plymouth, major-general in H.M. army. An improvement in screw propelled ships.

1427. H. Ashworth, Hyde, Chester, machine agent. Improvements in machinery for opening and carding cotton and other fibrous substances.

1429. A. B. Freeland, 4 Chatham-terrace, Palace-road, Upper Norwood. Improvements in the preparation or treatment of hops.

1431. T. Buckney, Peckham-rye, gentleman. Improvements in portable "tell tale" time-keepers. (A communication.)

Dated May 13, 1862.

1433. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the mode of carrying out submerged and other engineering works. (A communication.)

1435. P. M. Lopez, Paris, gentleman. Improvements in apparatus for sowing wheat or other grain or seeds.

1437. W. E. Newton, 66 Chancery-lane, C.E. Improvements in coffee pots and boilers for culinary purposes, part of which improvements are also applicable for generating steam. (A communication.)

1439. G. Blake, Trowbridge, Wilts, engineer. Improvements in apparatus for warming apartments.

1441. R. A. Lloyd, 11 Duke-street, Southwark. Improvements in the manufacture of bacon.

1444. W. Hartican, Islingword-road, Brighton, boiler-maker. Improvements in fire escape apparatus.

1445. R. A. Brooman, 166 Fleet-street, patent agent. An improved means or apparatus for shunting trains. (A communication.)

1447. W. Southwood, Kensington, C.E. Improvements in machinery for manufacturing nails from either hot or cold bars of iron or other metal.

1448. R. M. Latham, 71 Fleet-street, secretary. Improvements in steering apparatus. (A communication.)

Dated May 14, 1862.

1453. R. A. Brooman, 166 Fleet-street, patent agent. An improved method and apparatus for the production of photographic and stereoscopic portraits and pictures. (A communication.)

1454. J. W. Girdlestone, Canada Works, Birkenhead, C.E. Improvements in projectiles.

1455. H. Deacon, Appleton-house, Appleton, Lancaster, alkali manufacturer. Improvements in the manufacture and production of certain colours, and in the apparatus employed therein.

1457. E. Whittaker, spinner and manufacturer, and J. Clare, carder, Hurst, Lancaster. Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

1459. J. Smith, sen., Coven, near Wolverhampton. Improvements in thrashing machines.

1461. A. Nicole, 11 Soho-square, watchmaker. Improvements in stop watches and time keepers, and in instruments for measuring accurately short intervals of time.

Dated May 16, 1862.

1478. P. M. Parsons, Blackheath, C.E. Improvements in ordnance and other fire-arms, and in tools for rifling the same.

1480. G. Haseltine, 100 Fleet-street. Improvements in churns. (A communication.)

1484. A. A. Lamiable, 2 Rue Ste. Appoline, Paris. Improvements in cementing cast and wrought iron to obtain cast steel.

1488. G. Davies, Serle-street, Lincoln's-inn. Improvements in the manufacture of ribs for umbrellas and parasols, part of which is applicable to the hardening of strips of steel generally. (A communication.)

1492. F. Stocken, Halkin-street, Grosvenor-place. Improvements in carriages.

1494. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved machinery applicable to the cutting of leather and other like uses. (A communication.)

Dated May 17, 1862.

1495. C. Binks, Parliament-street, Westminster. Improved methods of obtaining oxygen and chlorine gases.

1498. R. Davison, London-street, C.E., and T. Johnson, Bermondsey, engineer. Improvements in machines for washing and cleansing casks.

1500. J. Hogg, jun., 4 Orleans-villas, Twickenham. Improvements in book-covers.

1502. J. C. Hill, Knoll, Abergavenny, Monmouthshire, ironmaster, and D. Caldick, Ebbw-vale, Monmouthshire, furnace builder. Improvements in puddling furnaces.

1506. F. E. Sickels, New York, U.S. An improved apparatus for steering vessels.

Dated May 19, 1862.

1508. J. Wright, 42 Bridge-street, Blackfriars, C.E. An improved method of sheathing iron or metal ships, in order to protect them from the action of salt water, fouling, and other such like influences.

1510. R. Ramsden, Kingsland-road, engineer. Improvements in machinery or apparatus for mashing malt.

1514. J. Lee, Church-gate, Leicester, engineer. Improvements in the construction of traction engines.

Dated May 20, 1862.

1518. M. A. F. Mennons, 21 Rue du Mont Thabor, Paris. Improvements in certain descriptions of breech-loading fire-arms. (A communication.)

1524. W. Clark, 53 Chancery-lane, engineer. Improvements in paddle and other hydraulic wheels. (A communication.)

1528. W. Petrie, Charlton, gentleman. Improvements in vessels for boiling chemical products as sulphuric acid, and in apparatus for indicating the degree of concentration and temperature of such products in the boiler, which apparatus is applicable to other pyrometric purposes.

Dated May 21, 1862.

1532. W. H. Burnett, Margaret-street, Cavendish-square, gentleman. Improvements in the mode of working telegraphic lines, and in instruments and apparatus employed for telegraphic purposes.

1534. W. Bush, Tower-hill, C.E. Improvements in the construction of ships, and in shields or armour for ships and batteries.

1536. L. Leins, Bucklersbury. Improvements in travelling bags and apparatus used therewith.

1538. W. E. Newton, 66 Chancery-lane, C.E. Improvements in the manufacture of metallic or mineralized fabrics or surfaces. (A communication.)

Dated May 22, 1862.

1540. C. W. Siemens, 3 Great George-street, Westminster. Improvements in electric telegraph apparatus. (Partly a communication.)

1546. J. Kennedy, Whitehaven, Cumberland, shipbuilder. Improvements in protecting the sides and decks of ships from the effects of projectiles.

1550. H. Cook, Manchester, gentleman. Improvements in electric batteries. (A communication.)

1552. W. Evans, Commercial-road, East, master mariner. Improvements in obtaining motive power by machinery.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1547. A. B. Childs, 481 New Oxford-street, engineer. Improvements in wringing machines. (A communication.) Dated May 22, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

175. H. Owen. Manufacture of stockings.
178. A. Ripley. Pistons.
185. J. Longhurst. Chains and chain cable.
191. C. West. Insulation and covering of wire.
195. J. C. F. Mougin. Bascelonnettes or cradles.
197. D. Eddleston and H. Gledhill. Finishing fabrics.
198. E. A. Cutter. Sewing machines.
201. F. R. and A. Roberts. Ploughing or cultivating land.
202. J. Brown and J. Devonport. Lubricating apparatus.
206. C. W. Harrison. Printing, stamping, embossing, and perforating.
212. T. J. Rowbotham, and N. Hackney. Purifying slip glaze and other potters materials.
214. H. H. Trepass. Kaleidoscope.
222. S. C. Lister and J. Warburton. Preparing cotton for spinning.
225. R. Bodmer and W. Wilson. The manufacture of artificial fuel.
238. B. Foster and J. Moore. Spinning and doubling fibrous materials.
242. M. Collier. Looms for weaving.
244. M. Allen. Construction of buildings.
245. T. Gontard. Truss plates.
247. J. Firth. Finishing mohair cloth.
269. W. Smith. Manufacture of bricks.
283. D. Joy. Forging metals.
287. W. E. Newton. Machinery for spinning. (A communication.)
290. G. Manwaring. Flushing apparatus.
300. W. E. Taylor. Carding engines.
308. J. H. Payne. Preparation of hemp and flax.
318. E. T. Bellhouse and W. J. Dorning. Hydrostatic presses.
386. J. F. and J. Lawton. Manufacture of flannel.
438. J. Nasmyth. Obtaining a circular motive power.
449. G. F. Lee. Tourniquets. (A communication.)
500. J. Woodrow. Manufacture of hats.
511. W. McI. Cranston. Reaping and mowing. (Partly a communication.)
580. J. H. A. Quiquandon. Jacquard machines.
614. A. C. Mac Leod. Hats.
712. W. Clark. Brake. (A communication.)
904. W. McI. Cranston. Cutting corn. (A communication.)
1109. J. Stanton. Stamping or piercing metal washers.
1187. A. V. Newton. Looms. (A communication.)
1193. H. Wheatley. Heating or drying.
1231. S. and G. Cheavin. Filtering and purifying.
1287. J. Swallow and J. Allinson. Manufacture of carpet fabric.
1313. T. Cabourg. Boots and shoes.
1330. J. H. Johnson. Production of minium or red lead. (A communication.)
1332. J. H. Johnson. Manufacture of soda and potash and of their carbonates. (A communication.)
1371. W. Gossage. Manufacture of soap.
1379. J. Fowler and J. King. Tilling land.
1439. G. Blake. Warming apartments.
1450. C. T. Porter. Steam engine indicators. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated May 30, 1862.

3024. G. Ralston.
3036. J. Hemingway.
3040. H. G. Hacker.
3044. R. A. Brooman.
3048. J. Kunwelden.
3052. J. Cochrane.
3060. J. D. Napier.
3068. G. Clark.
3072. W. N. Hutchinson.
3167. S. Sheppard.
3185. A. Treuille and F. X. Traxler.
3195. W. Clark.
17. J. J. Gutknecht.
70. A. R. Le M de Normandy.
327. A. McKenzie and J. Panthel.
355. J. Sim.
791. T. Marsh.
903. H. Pooley.
933. J. T. Loft.

Dated June 3, 1862.

3065. H. G. Schramm.
3067. T. Lewes.
3069. R. Jolley.
3075. T. Mellodew, C. W. Kesselmeyer, and J. M. Worrall.
3076. B. W. Gerland.
3082. J. Fordred.
3090. H. Alexander.
3091. V. L. Dagron.
3115. W. E. [illegible]
3117. W. S. [illegible]
3249. E. Lord.
3263. T. and W. [illegible] R. Mathers.
368. T. Coltman.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1304. G. F. Chantrel.
1311. W. Weild.
1321. R. A. Brooman.
1325. A. Smith.
1326. W. Grimshaw.
1331. G. Maggs.
1335. A. Mickelthwaite, J. Pease, and S. J. Hobson.
1361. J. Wilson.
1370. A. R. Arrott.
1380. R. Barclay.
1395. C. De Bergue.
1725. T. Webb and [illegible] Craig.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1221. J. B. Acklin.
1243. C. T. Dunlop.
1268. H. Cartwright.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending May 31, 1862.

No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.
2538	0	7	2554	0	3	2570	0	11	2586	3	7	[illegible]	1	3
2539	0	6	2555	1	5	2571	1	[illegible]	2587	0	2	[illegible]	[illegible]	3
2540	1	3	2556	0	6	2572	1	[illegible]	2588	0	9	[illegible]	1	10
2541	1	3	2557	0	3	2573	1	4	2589	0	10	[illegible]	1	1
2542	0	11	2558	1	4	2574	0	[illegible]	2590	0	9	[illegible]	1	2
2543	0	7	2559	0	6	2575	0	[illegible]	2591	0	0	[illegible]	1	5
2544	0	6	2560	0	3	2576	0	11	2592	0	8	[illegible]	1	2
2545	0	3	2561	0	6	2577	[illegible]	[illegible]	2593	[illegible]	5	[illegible]	1	4
2546	0	3	2562	0	10	2578	0	11	2594	0	6	[illegible]	1	4
2547	0	3	2563	0	3	2579	1	[illegible]	2595	0	6	2610	1	3
2548	0	6	2564	0	5	2580	1	[illegible]	2596	0	8	[illegible]	1	9
2549	1	10	2565	0	11	2581	1	[illegible]	2597	0	7	[illegible]	[illegible]	3
2550	0	3	2566	0	3	2582	1	[illegible]	2598	0	7	[illegible]	1	0
2551	0	3	2567	0	6	2583	1	[illegible]	2599	0	10	[illegible]	[illegible]	3
2552	0	9	2568	1	4	2584	1	7	2600	0	5	[illegible]	1	10
2553	0	3	2569	2	[illegible]	2585	1	[illegible]	2601	0	4	[illegible]	1	6

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, June 5, 1862.

		£	s.	d.		£	s.	d.
IRON:								
Rails in Wales and North of England	pr. ton	5	0	0	to	[illegible]	[illegible]	[illegible]
Welsh Bars, in Wales	„	5	5	0	„	[illegible]	[illegible]	[illegible]
Staf. Bars, at the Works	„	7	0	0	„	[illegible]	[illegible]	[illegible]
„ Hoops	„	7	10	0	„	[illegible]	[illegible]	[illegible]
„ Sheets, Singles	„	9	0	0	„	[illegible]	[illegible]	[illegible]
„ Nail Rods	„	0	15	0	„	[illegible]	[illegible]	[illegible]
„ Boiler Plates	„	8	0	0	„	[illegible]	[illegible]	[illegible]
Scotch Pig, M. Nos. Warrants, at Glasgow	„	2	10	0	„	2	11	[illegible]
Do. No. 1, Good Brands	„	2	11	6	„	[illegible]	[illegible]	[illegible]
Scotch Bars	„	7	5	0	„	[illegible]	[illegible]	[illegible]
Swedish Bars, in London	„	10	10	0	„	11	[illegible]	[illegible]
COPPER.								
Sheet and Sheathing	per lb.	0	0	11	„	[illegible]	[illegible]	[illegible]
Tough Cake and Tile	pr. ton	96	0	0	„	[illegible]	[illegible]	[illegible]
Best selected	„	101	0	0	„	[illegible]	[illegible]	[illegible]
Australian	„	99	0	0	„	[illegible]	[illegible]	[illegible]
South American	„	0	0	0	„	[illegible]	[illegible]	[illegible]
Yellow Metal Sheathing	per lb.	0	0	9	„	[illegible]	[illegible]	[illegible]
STEEL.								
Swedish Keg	pr. ton	15	0	0	„	[illegible]	[illegible]	[illegible]
„ Faggot	„	16	0	0	„	[illegible]	[illegible]	[illegible]
TIN:								
English, Block	p. cwt.	6	0	0	„	[illegible]	[illegible]	[illegible]
„ Bar	„	6	1	0	„	[illegible]	[illegible]	[illegible]
Foreign, Banca	„	6	5	0	„	[illegible]	[illegible]	[illegible]
„ Straits	„	0	17	0	„	[illegible]	[illegible]	[illegible]
TINPLATES:								
Charcoal, I.C.	pr. box	1	7	0	„	[illegible]	[illegible]	[illegible]
Coke, I.C.	„	1	1	6	„	[illegible]	[illegible]	[illegible]
LEAD.								
Pig, English	pr. ton	20	0	0	„	21	[illegible]	[illegible]
„ Spanish	„	19	10	0	„	19	[illegible]	[illegible]
Common Sheet	„	21	0	0		[illegible]	[illegible]	[illegible]
Tea „ [Wimshurst's Patent] A special disct.	„	35	0	0	„	[illegible]	[illegible]	[illegible]
SPELTER:								
On the spot	„	17	10	0	„	18	[illegible]	[illegible]
For arrival	„	17	10	0	„	17	[illegible]	[illegible]
ZINC.								
English Sheet	„	23	0	0	„	[illegible]	[illegible]	[illegible]
QUICKSILVER	pr. btl.	7	0	0	„	[illegible]	[illegible]	[illegible]

JAMES LAURIE, Metal Broker,
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 13, 1862.

THE AUSTRALIAN SOVEREIGN.

It is satisfactory to note that Mr. Alderman Salomons has at length obtained the nomination of a Select Committee of the House of Commons, for the purpose of enquiring into, and reporting upon, the amount of good or evil which would be likely to accrue from the legalization in England of the Australian sovereign. We have on several occasions shewn the utter absurdity of maintaining the legal enactment which prevents the free circulation of gold coins of the Sydney mint in this country. The interdictive law is "frivolous and vexatious" in the extreme, and ought never to have been promulgated. If the Committee devote but an ordinary share of attention to the question, they will, we are convinced -and that within a short period—report at least in favour of making the Australian sovereign, and half-sovereign, legal tenders in the mother country. It was rather surprising, however, to find a gentleman, who from his antecedents and present position ought to have known better, asserting in the House that it would be a dangerous thing to allow to Australia the privilege of minting gold which should afterwards be free to circulate in the United Kingdom. We had thought that Australia was part of the British Empire, that the mint of Sydney was a *branch* of the mint in London, and that our fellow subjects at the antipodes ought to be treated as friends, and not foes. Mr. Hankey, however, it appears, thinks differently. He imagines that the Royal Mint ought to enjoy the exclusive privilege of coining, and the Bank of England that of controlling the mint's movements. Those two establishments constitute, in his estimation, the *summum bonum* of all minting arrangements, while the colonies are to be but importers and purveyors of the raw material for their use. Mr. Hankey thinks that if the Australian sovereign had been made a legal coin on this side the globe we should have been by this time inundated with them. "The £100,000,000 which had resulted "from the diggings would have come over in "the shape of sovereigns," and the imperial coinage would have been swamped. Thus argues Mr. Hankey. Had he been aware that the Sydney mint possesses only three coining presses, and that it cannot coin a million of sovereigns, or even half-sovereigns, in less than six weeks or two months, the gentleman named would not have ventured to make such statements. Whilst the Imperial Government limits the power and action of the branch mint at Sydney, as it does at present, it is physically impossible for the prediction of Mr. Hankey to be realized.

It would be palpably unwise for the owners of gold to deposit that material at a place where it might remain for six months without being converted into coin. Where, indeed, would be the interest in that case on the amount?

The Committee will probably sift the matter for themselves, and if they eventually recommend the imperialization of the Australian gold coinage, they will do themselves honour, and the state much service. The Committee is composed of the following gentlemen:—Mr. Alderman Salomons, the Chancellor of the Exchequer, Mr. Henley, Mr. Hankey, Mr. Hubbard, Mr E. Fortescue, Mr. Fitzgerald, Mr. Marsh, Mr. T. Baring, Lord A. Churchill, Sir. F. Heygate, Mr. Locke King, and Mr. J. Hardy. They are to be entrusted with power to send for persons, papers, and records, and it may be trusted that among the first named may be found some gentlemen from New South Wales, and Victoria, in both of which colonies, to say nothing of Queensland and South Australia, the deepest anxiety exists in regard to the subject.

For ourselves, we shall watch with great interest the proceedings of the Committee, having all along felt that our colonial fellow subjects were much wronged by the existing arrangements, while at home no good whatever resulted from them.

INTERNATIONAL EXHIBITION OF 1862.

ELECTRIC TELEGRAPHS AND ELECTRICAL APPARATUS.

[First Notice.]

Occupying so minute a space among the teeming products of mere demonstrative industry, and dwarfed into apparent insignificance by comparison with the Cyclopean grandeur of vast machines for the subjection of material Nature,—this collection of simple and beautiful apparatus for examining and utilizing the mightiest of her immaterial and invisible forces, though deeply interesting to all lovers of science, will be too readily passed over by the general throng who visit the building at South Kensington. And yet the practical influence of electrical invention has been by no means unfelt even in a popular and every-day sense, either in contributing to render the Exhibition itself a possibility, in ministering to the convenience of the thousands who daily assemble within its walls, or even in aiding its executive to control the financial concerns of the undertaking. In this latter capacity, it meets us at the very threshold, where the valuable and ingenious "Magnetic "Tell-tale" of Professor Wheatstone is already attached to some of the turnstiles. This instrument, unlike some previous attempts in the same direction, is worked without battery-power of any kind. The electricity is generated by a magnetic machine of peculiar construction, connected in such manner with the axis of the turnstile as to discharge a current of its force at each revolution of the stile. Thus each visitor, as he or she passes through it, unconsciously and telegraphically announces his or her arrival to the financial officer of the Commissioners, in whose rooms are fixed the instruments for receiving and recording the liberated current, which latter is conducted thither by a line of copper laid along the building between those instruments and the turnstiles, and metallically connected to each. The registers thus obtained form a complete check upon the money taken at the doors, and they are produced automatically, requiring only the current evoked by the revolving turnstile to set in motion the electrical apparatus whereby they are recorded.

Having announced our arrival in this novel manner, we soon find on entering the building some further indications of the presence of the electrical element, in the shape of announcements that the wires of the Electric and International Telegraph Company have been already introduced for the accommodation of the public, and that, from either of two offices, the one facing you on entering from the Cromwell-road, and the other adjoining the post-office, under the north-east tower, messages can be sent to all the telegraphic stations of the world.

The company referred to have, by virtue of a money payment to the Commissioners, secured the exclusive privilege of administering in this respect to the wants of Her Majesty's lieges and others, within the walls of the Exhibition—a proceeding, by the way, not quite in accordance with the free-trade principles of which these Exhibitions are supposed to be in some sense exponents and illustrations.

One of the excluded companies, however (the Submarine), determined not to be beaten, and having hired a piece of vacant ground in the Cromwell-road, nearly opposite the south-east tower, has erected thereon a gay little Kiosk-like building—redolent of Owen Jones as to its external colours, and supplied internally with all the requisites of a telegraph office. Into this are brought the company's wires, which, in connection with their own cables and with the wires of the Magnetic Telegraph Company, are thus in communication with all the British and Continental stations. From this position, defiant with international bunting, they are enabled to wage vigorous competition with their privileged rivals, apparently not without success, for the large amount of telegraphic business evoked by the occasion.

In connection with the subject of telegraphs, and bearing in mind that the Decennial Period is now coming to be looked upon as the epoch at which to reckon up the gains or losses of art and science, as well as those of population and other matters involved in social and political statistics, it may not be uninteresting or out of place, as introductory to a notice of the various objects in this department of the Exhibition, to glance at the progress and extension of telegraphy since the Exhibition of 1851. Fortunately, we are enabled to say that this has been most marked and encouraging.

At the beginning of 1851, about 3,000 miles only of telegraph had been erected in Great Britain;—the submarine lines to Ireland had barely been thought of, nor had a single line (even of aërial telegraph) been erected in that country. Owing to deficient knowledge as to the best mode of insulating telegraph wires, it was at that time also a difficult feat to telegraph through 200 miles of conductor, in a direct unbroken circuit, even upon the best pole lines, and it frequently happened that a message had to be read off and sent forward three or four times between London and Liverpool.

Ten years have passed away, and there are now upwards of 10,000 miles of aërial telegraph in full work in the United Kingdom alone. In Ireland the system of the Magnetic Company has been erected over every railway in the country, and so important is the business that has grown up in consequence, that the Electric and International Telegraph Company are also now preparing to extend their wires along the highways to some of the principal towns in that island. Queenstown has become the depôt for the shipment of American mails, and hence the latest intelligence from across the Atlantic is now received there in the first instance, and made known to the British public some sixteen hours earlier than it used to be by means of the four submarine cables, with their seventeen conducting wires, which have, since 1851, annihilated the intermediate sea so far as this purpose is affected by it. On the continents of Europe, Asia, India, and America, the extension of the telegraph has been equally remarkable during the past decenniad. In the latter division of the globe upwards of 45,000 miles of telegraph are now in existence, and in the former ones the wires have been extended to the very verge of civilized life, and even to Omsk in Siberia, from whence it is contemplated to push forward, if possible, to Russian America.

Nor has the more specially scientific portion of this question stood still during the two departed lustra. We have alluded to the difficulty formerly experienced in telegraphing to any considerable distance without a

This is now a thing of the past. The electric current, day by day carries on the telegraphic business between London, Liverpool, and Manchester without break or disturbance of circuit. Between London, Glasgow, and Edinburgh the same condition of things is now the rule. Along the cable laid, in 1860, beneath the sea, between Toulon and Algiers, at a depth of 1,700 fathoms and for a distance of 600 miles messages are hourly chasing each other at the rate of 14 words per minute; and between Malta and Alexandria similar wonders are performed; nay, more astonishing than all, the Atlantic itself has been spanned by the electric wire, and messages have been freely exchanged through its unbroken circuit of 2,100 miles. We have spoken hitherto of direct circuits only, but by means of relays, which are applicable to aërial lines, the most remarkable experiments have lately been successfully performed. At a telegraphic soiree given by Mr. Gurney, M.P., on the 26th March in the present year, the wires of the respective companies were brought into his house at Prince's Gate, and from thence the Earl of Shaftesbury sent a message to St. Petersburgh, and in four minutes received a reply from that city. Conversation was held by telegraph with the Lord Lieutenant of Ireland, and, at last, in order to test what was possible, an unbroken circuit of 5,000 miles was made by causing the wires to be joined, so as to communicate with Verona, by way of Brussels, Berlin, St. Petersburgh, Moscow, Kief, Temesvar, Trieste, and Venice. Throughout this stupendous distance the electric force was flashed in the incredible space of two seconds!!

In submarine telegraphy separately the progress has not been without mark, notwithstanding some few serious backslidings and several fearful mistakes. The first cable was laid between Dover and Calais in the autumn of 1851. At present, eight electrical mouthpieces, containing thirty conductors, and measuring, in the aggregate, more than a thousand miles, supply, at the rate of four hundred thousand messages per annum, the greed of intercommunication which has grown up between England and the rest of Europe.

India, too, has been brought thirteen days nearer to the central government than heretofore, and in all, upwards of 12,600 miles of cable, containing more than 18,000 miles of insulated wire have been submerged. Would that we could add that equal success had attended each separate enterprize. Spite, however, of jobbery, of concession-mongering, of hurry, mistakes, and inexperience, and thanks mainly to the care and enterprize of two great firms—the Gutta Percha Company, and Messrs. Glass Elliot and Co.—some 5,000 miles of cable are still at work with every prospect of permanence, and though this seems but a small proportion, it must be remembered that the losses of the Atlantic, the Red Sea, and the Mediterranean Extension companies alone (three separate adventures among fifty), amounted to more than 7,000 miles of cable.

In the present Exhibition nearly all the objects exhibited in illustration, as well of the pure science of electricity, as of its telegraphic offshoot, are comprehended under Class 13. In this Class there are in all sixty-eight exhibitors, whose nationalities may be summarized as follows:—Twenty-nine British subjects, fourteen French, five Austrian, five Dutch, five Belgian, four Italian, and two each from Switzerland, Prussia, and Denmark respectively. Their productions are chiefly to be found in the galleries of the Exhibition—the British articles being in the north, and the French in the south-west galleries. The eastern and western annexes also contain articles interesting to the telegraphist and to the electrician which have found their way into other classes.

As a whole the display must be looked upon as more excellent for increased care and perfection of manufacture, and for new adaptations, and improvements of inventions, long previously known in a less practical form than as possessing among the objects exhibited anything strikingly new or original.

Noticing first the illustrations of submarine cable-making, past, present, and projected, we have first the Gutta Percha Company, who, in order to set forth the purity of the material in which they deal, and the facility with which it can be handled, exhibit in the eastern annex two frames, each about 4 feet square, within the space enclosed by which pure gutta percha, rolled out to a tenuity little less than that of a soap bubble, is stretched like a picture glass. The surface is perfectly even, and quite diaphanous, being infinitely less opaque than those ancient contrivances of horn, and other substances, with which not many ages ago our forefathers were wont to make darkness visible. The same company also exhibit in the gallery some very good specimens of insulated conductors ranging from a thickness suitable for a 2,000 mile cable, down to a size small enough for surrounding the coils of electro magnets. One mile of this latter beautiful thread is contained in a ball about the size of an ordinary breakfast cup. We have also numerous other specimens of "cores," or insulated centres of cables, of which the Gutta Percha Company exhibit fifty-one specimens, being separate examples of each of the cores manufactured by them since 1850; and as we believe no other manufacturer has at present been employed to make this portion of any actually submerged cable, this may be taken to be also the number of submarine telegraphic communications that have been projected. These specimens are arranged on a board in the order of time at which they were manufactured, and are to be seen in the north gallery.

Messrs. Glass, Elliot and Co. similarly display specimens of some thirty cables which they have completed from cores made by the Gutta Percha Company, and submerged by means of their own staff (Messrs. Canning, Clifford, De Sauty, &c.). Their aggregate length as laid is over 3,900 miles, and the whole of this, as we are encouragingly informed, is in perfect working order.

Messrs. Silver and Co. also display many very interesting specimens of their proposed method of insulating telegraphic cables with India rubber, as likewise do Messrs. Siemens, and Messrs. Hall and Wells. The variations in the proposed methods of using india-rubber are considerable.

Messrs. Silver use the masticated rubber, which is cut into strips, and laid spirally, in one or more coats, around the conductor, the edges being united by means of a solvent.

Messrs. Hall and Wells, on the other hand—whose process, by the way, appears to be preferable—use the pure Para rubber, which, being cut into long strips by machinery, is stretched to its full extent, and in that state of tension laid spirally upon the conductor, around which it collapses with great force, adhering by simple pressure, and forming a sound and solid insulator, which, if found in practice to be as unaffected by sea water as gutta percha is known to be, may hereafter be extensively employed.

The plan of Messrs. Siemens differs from both these, and consists in laying the strips of Para rubber longitudinally to the conductor, the freshly cut edges of the former being united by compression, by means of a very ingenious machine, which may be seen in action in the Western Annex. The chief peculiarity of this machine consists in its having two grooved pressing rollers, and two shearing or cutting rollers. The latter are so arranged on each side of the former that, in turning round, their cutting edge crosses the edges of the grooved rollers at a point where the distance between the edges of the latter is about equal to half the thickness of one of the strips of india-rubber to be used.

There are suitable guides for leading both the wire to be covered and synchronously with this the india-rubber strips or tapes into this machine. The two strips close over the wire, and are drawn tight over it by the inner edges of the grooved rollers, and compressed to one-fourth of the original thickness, the spare material being forced out from the middle; the cutting rollers then suddenly intersect them, cutting off the superfluous material thus pressed out. By means of a train of these machines three or four coatings can be laid on at the same time. The plan of Messrs. Siemens for the external coating of cables, consists in surrounding the core with tape saturated with shell lac and pitch; this mixture is in turn to be finally surrounded by a band of brass sheathing, wound on while the cement is still soft, the completed cable being afterwards drawn through a hot die.

Several other varieties of cables are shown, among which may be mentioned Duncan's rattan covered cables, those of Rogers covered with plaited hemp, and in the French gallery some specimens of india-rubber cables covered with hemp, exhibited by Messrs. Rattier.

Applicable to aërial lines, and among the objects exhibited by the Magnetic Telegraph Company, we have the insulators of Sir Charles Bright, particularly the double-shackle insulator for use where great strain is required—it is well adapted for over-house telegraphs, in which it has been extensively used. Mr. C. F. Varley, the electrician to the Electric and Atlantic Companies, also shows an ingenious and efficient form of insulator which presents some novel features. Each insulator consists of two or more distinct insulators, one within the other, made of hard porcelain, and each separately tested as to insulating quality before being put together.; they are then combined by hard cement, and form a cup within a cup; the iron pin, previously covered with hard ebonite is afterwards cemented to the inner cup. The advantage of this arrangement is that three distinct insulators are thus formed in one, all of which must fail before the electric current can escape to the telegraph pole and so to earth.

Messrs. Silver also exhibit some very nicely made insulators of ebonite for aërial lines.

Of the apparatus for practically observing and utilizing electric force, one of the most novel and ingenious is the instrument exhibited by Mr. C. F. Varley, for ascertaining the distance of defects in telegraphic circuits, which, as no name has been affixed to it, we may fairly term for the nonce, at all events, an "Electrical "Babbage." This is a machine which, by mechanical arrangement, indicates in two electrical readings the distance from the observer of a defect of insulation in a line of telegraph, aërial or submarine. It consists of a differential galvanometer—that is to say, a galvanometer the helices of which are wrapped with two wires, precisely equal in all respects, but connected up in opposite directions, so that when an *equal* amount of current is circulated through each wire they balance each other, and no indication is given on the galvanometer. In addition to this, the instrument consists of an ordinary telegraph key, and what is termed a "switch" (a means of changing the circuit).

Seven binding or connecting screws are also attached to the machine. Two of these are respectively labelled "copper," and "zinc," and connected with those poles of the battery used for testing; two more of the screws are terminals, connected with a series of metallic resistance coils, so arranged, that a resistance to conduction equal to one, or as many more miles of perfect line as may be necessary, can be inserted at pleasure into the circuit. A fifth binding screw or terminal is labelled "earth," with which it is connected; a sixth is labelled "bad line," that is, the line to be tested; the seventh terminal is labelled "good line."

The key will put the two wires of the galvanometer in contact with the battery; the switch is for putting the other pole of the battery in contact either with the "earth," or with the end of the box containing the resistances, as may be desired. These two positions of the switch are labelled respectively "numerator" and "denominator." Now for the *modus operandi.*

If in a line of telegraph, consisting of more than one wire, one of the wires be discovered to be leaky, the station whose duty it is to test for this fault telegraphs to the next station beyond the fault, and instructs him to join on to the bad wire a good wire, that has no leakage. This done, the good wire at the observer's end is attached to the binding screw labelled "good line;" the defective wire is, at the same time, attached to the binding screw labelled "bad line." The galvanometer now shows a deflection equal to the escape of electricity at the fault. Mile after mile of the resistance coils before-named is now introduced between the bad line and the galvanometer, until the resistance to conduction from the galvanometer, through the resistance coil and the bad line to the defect is shown on the galvanometer to be exactly equal to the resistance through the good wire to the distant station, and back to the leak.

The amount of resistance necessary to effect this is put down as a "*numerator*." The switch is then turned to the side marked "denominator," which is so connected as to enable the operator to measure the whole resistance of both good and bad wires.

This second amount is set down as a denominator. The two amounts thus form a vulgar fraction, which represents the distance of the fault from the distant station; thus:—supposing the numerator and denominator to come out as 4-5ths, and the distance between the observer and the far-off station to be ten miles, the fault would be found at 4-5ths of ten miles from the latter station; that is to say, at eight miles distance.

(To be concluded in our next.)

"MEMOIRS OF DISTINGUISHED MEN OF SCIENCE."*

In our notice last week of Mr. Walker's engraving of the distinguished men of science, we were only able to make a passing mention of the book of memoirs which accompanies it. As, however, this book is to be obtained separately, and has evidently been written with care, we will now speak further as to its deserts. In the preface the writer claims the merit only of a compiler, with one or two exceptions, and he expresses a hope that he may have performed his task with clearness and brevity, not neglecting, at the same time, to present his facts in a readable form. The combination of these three qualities is not often to be met with in a series of short biographies, and we are, therefore, glad to be able to say that Mr. W. Walker has, in a great measure, succeeded in accomplishing this. We would particularly call attention to the notices of Cavendish, Samuel Crompton, Dr. Jenner, Count Rumford, and Dr. Thomas Young, as instances of the successful manner in which good sketches of character have been interwoven with plain records of the facts occurring in the lives of these eminent men. The memoir of James Watt is also well put together, and it must have cost the writer considerable labour to compress into the space of six pages so clear an account of the numerous works of this great philosopher and engineer.

The biographies which claim particular notice, from containing original information, are those of Tennant, Maudslay, and Trevithic. The life of Charles Tennant, the founder of the celebrated chemical works at St. Rollox, Glasgow, gives to the public for the first time a sketch of the career of one whose inborn energy of character and clear intellect (to use the author's words), placed him among the foremost of those men who, by uniting science to manufactures, have entitled their occupations to be classed among the ranks of the liberal professions.

Mr. Walker's information regarding Maudslay is, we are sorry to see, rather meagre. Two interesting facts may, however, be mentioned, namely, that Henry Maudslay, in early life, worked for some years at Bramah's establishment at Pimlico, and while engaged there constructed the identical padlock which subsequently gave Mr. Hobbs so much trouble to pick; also, that the engines of the Regent (24 H.P.), the first steamboat which ran between London and Margate, were constructed, in the year 1816, at Maudslay's establishment at Pimlico. But the memoir the perusal of which will afford the greatest interest to engineers is that of Trevithic. Without pretending to anything like a life worthy of the genius of this extraordinary man, it is, notwithstanding, the most complete biographical notice which has yet been published of him. One anecdote we will quote as highly illustrative of his reckless character. During Trevithic's romantic sojourn in Southern America, he discovered, among other things, some valuable mineral deposits, and obtained from the government a grant of the land which contained them. On returning to England, "he succeeded, by his "representations (which were confirmed by a "Scotchman of the name of Gerard, who had "been his companion), in organizing a company for sinking the necessary mines. Before, "however, active operations were commenced, "Trevithic one day entered the new company's offices to arrange finally about his own "interest in the concern. A cheque for £7,000 "(a much larger sum is stated by one gentleman) was at once offered as purchase money "for his land in Southern America. This, "however, was not what he had wanted, and "without giving a thought to the largeness of "the sum offered, he indignantly threw back "the cheque across the table, and walked out "of the office. After this the company broke "up, and Trevithic never realized a penny "piece from his really valuable possessions "in that country." The anecdote we have just related is vouched for upon the authority of the late Michael Williams, M.P. for Cornwall, and we certainly agree with the sentence which concludes the memoir of Trevithic, that "his "life remains a record of constant but brilliant "failures, and that from no inherent defect in "his inventions, but solely from the absence in "his character of that perseverance and worldly "prudence necessary to bring every new undertaking to a successful commercial issue." In completing our notice of this work, we ought to mention that the first few pages are devoted to an introduction by Mr. Robert Hunt, F.R.S., in which is introduced a letter from Lord Brougham, of which both the Messrs. Walker may well be proud. We trust the book may be extensively read, as it affords interesting information, in an easily accessible shape, of men, the memory of whose deeds is too liable to pass away.

OUR HARBOUR DEFENCES.

The Defence Commissioners prove they have little confidence in their case by having recourse to notions—we will not call them arguments—so far-fetched and hypothetical as those they publish to support their conclusions.

After a careful analysis of their Report, we are impressed with the idea that they have thought more of the defence of the proposed forts against attack than of their means of attacking and stopping an enemy's flotilla, intending to steam past the forts, and elude their fire. This is a serious mistake, which transposes the real question, and may mislead our Legislators, as it appears to have misled the Commissioners themselves, if it is not pointed out in plain terms.

Referring to the observations on this point in the last magazine, we will add a few words. Iron-clad ships, intending to attack a port or arsenal, would not attempt to silence a fixed fort with horizontal fire. They might do so with vertical or plunging fire at long range, and unmolested; but their real business would be not to fight the forts, but to pass by them just as the Federal vessels did in the Mississipi affair.

"The real question," says the Report, "is, "whether additional effect is to be given to the "power of the moveable defences by providing "fixed supports as a basis for their operations?" The real question, *we say*, is, whether defences replacing fixed forts in the form of floating batteries of great power moored at fixed stations, but *moveable at will*, would not afford more efficient support, and form a better base for the operations of the more active moveable defences. These active moveable defences, of which the necessity and the urgency of calling them into immediate existence are admitted by every body, are one thing; the stationary floating batteries to replace the forts are another thing, and must not be confounded with iron-clad vessels of power and speed for harbour and coast defences. A floating battery of immense force, which would do all the work a fixed fort could do, can be constructed at half the price, and it will be much more efficient, for it can advance or retire, and choose its position, which the fort cannot do. By separating the two classes of armour-plated floating defences, the difficulties of the case are removed, and the mystification in which the report envelopes the question is dissipated.

As an argument in the right direction—that is, in support of the attacking power of forts against ships coming within range of their guns—we find nothing to the purpose in the report, but the assumption that "in a short time guns "will be produced of sufficient power to penetrate at a considerable distance the heaviest "armour-plating that is compatible with the "necessary qualities of sea-going vessels." And then this assumption is followed up by another, that guns of suppositious colossal dimensions and weight may be mounted and worked on the platform of a fort, but could not be mounted or worked on a floating battery.

Here we have two imaginary propositions, neither of which has received any satisfactory elucidation in practice, and Parliament on no other foundation is asked to vote sums which soon will swell into millions. The *Times* supports the first of these arguments by suggesting that "if this conclusion be warranted, "then the nation may safely return to the "construction of the forts in which the late "battle threw a temporary discredit."

---

* Messrs. Walker and Son, 64 Margaret-st., Cavendish-square, W. Also to be obtained of Messrs. Spon, Bucklersbury.

Happily, the form of this suggestion raises an obstacle to the wanton expenditure of the public money, which, if the military and naval members who understand the question, and the economist members, who may see their advantage, will avail themselves of it, will defeat the Government project.

"If the conclusion be warranted?" That is the question. What evidence have we that rifled guns can be constructed which will penetrate iron armour-plates at ranges of 1,000 and 2,000 yards? Those complex problems which hitherto have baffled the science and skill of the most eminent engineers and mechanicians are comprised in this proposition:

1. The construction of rifled guns of enormous calibre, calculated to produce the theoretic effects relied upon, and of sufficient strength to resist the heavy charges they must carry.

2. The reliance to be placed on the calculated force of these monster guns at long ranges, supposing their construction to be possible.

3. The power of resistance of perfectly constructed naval armour, which is a question at present as little understood in practice as the construction of gigantic rifled cannon or their effect at long range.

The vague and unsatisfactory condition of these three problems is, or ought to be, well known to the scientific members of the Defence Commission. The Ordnance Select Committee, the Iron-plate Committee, and many other eminent scientific authorities who have paid attention to these questions, would, if consulted, testify that they are all in an experimental state affording no sufficient reason for sound conclusions.

The *reductio ad absurdam* of the final conclusion of the report may be thus put:—"Some "profound and very scientific calculations on "the effects of rifled projectiles at high velo"cities have been submitted to us by Sir "William Armstrong and other competent "artillerists, which show that a shot fired from "a 600 or 1,000-pounder gun will penetrate "armour plates at excessively long ranges. We "are aware that the proposed guns are not "made, nor can we tell when they will be "made. We know nothing positive as to the "resisting force of iron armour, for that ques"tion is still in the greatest doubt. But as "we are told by scientific calculations that "certain effects can be produced if certain guns "can be made, and can be fired when made, "and without at present knowing whether "floating batteries might not carry these great "guns, as well as forts, we recommend that the "Spithead Forts be erected ready to receive at "some remote and unknown period the "enormous artillery in embryo."

Is it possible to conceive a conclusion more groundless or illogical. Let Parliament require Government, before they spend the public money on forts in which to mount guns which do not yet exist, to wait until it is proved that rifled guns can be made to penetrate armour plates at 2,000 yards, and until it is proved whether stationary floating-batteries will not be more efficient than forts for the proposed defences.

It has been erroneously advanced that "land "batteries, which will permit the mounting of "the most colossal guns, and which themselves "may be faced with iron, must have an advan"tage over floating batteries, which are limited "both in the weight of their armour and of "their weapons."

This opinion is founded on a superficial view assimilating a floating battery and a sea-going ship, two structures differing in their nature, form, armour-plating, armament, and equipment more completely than an iron-clad line-of-battle ship and a mortar-boat.

Practically, there is no limit to the size or weight of guns or armour which can be carried by a floating battery. It can be constructed of enormously greater strength and capability of carrying heavy weights than a sea-going ship. A much larger proportion of the space and tonnage can be appropriated to carry guns and ammunition, and, if needs be, machinery to work the guns. The vessel would be relieved entirely of masts, yards, and sails. Her engine power and her steering gear would be adapted, not for speed, but for rapid evolutions on her centre. Her armour would be much heavier and more effective than a cruiser could carry. The grand consideration in her construction would be, power to carry the heaviest armament and strength to resist projectiles. A vessel intended only for harbour duty, a (locally) stationary, although floating structure, may be constructed so superior for defence or attack that no sea-going ship could contend against her. As her duty would never take her out of sight of land, in fact, would always keep her in harbour, a comparatively small part of the tonnage would be required for fuel, stores, and berths. Taking all these advantages into account, a floating battery of 2,000 tons might carry a more powerful armament than a line-of-battle ship; and if of 4,000 or 5,000 tons burden, with great breadth of beam, and low in the water, might be of so formidable a character that no fort could surpass her, and no sea-going ship could contend against her.

THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER XV.

THE PENETRATING AND CRUSHING EFFECTS OF PROJECTILES.

In a former letter I congratulated the public that the Mechanics' Magazine was made the battle field of scientific and practical discussion for the attainment of truth in matters affecting Government expenditure. "Iron walls," I hope, have done some good. Mr. Scott Russell has come forward to vindicate his system of armour plating. Mr. Grantham and other correspondents have noticed my endeavours to advocate truth. So many champions have in your columns taken up the cause of iron against wood, the subject is well ventilated. The continuous discussion of principles enlightens the public mind, and renders officials more disposed to admit the necessity of an iron navy.

Mr. Scott Russell is so sincere and devoted an advocate of iron, one cannot help regretting the failure of his plan of armour-plating. He is another addition to the list of men of science who have misunderstood the principles of construction of this new defence for ships. But sympathy for his disappointment is not a reason for allowing the plausible statement with which he covers his defeat to remain unanswered. The "facts" he adduces by no means improve his case. The "continuous rivetting," as he calls the frame fastening, is not altered in character by being "flush," or "round headed." In either form it is exposed to impact, is incapable of drawing the plate to a bearing, and is liable to be ripped off and split asunder by jar and vibration. These three sources of destruction were pointed out in my letter of the 7th March, and are proved to exist by the result of the trial.

2. The cause of the long and deep cracks in the iron of his target is that the plates are held loosely in their frames without being drawn to a bearing. Width has nothing to do with this result, and, in fact, the three-feet plate is cracked as badly as the two-feet plate.

3. If the frame of the target was not made by Mr. Russell, it was well constructed by Messrs. Mare and Co., and certainly is equal in strength to any frame used in other trials. As a whole, the structure had the advantage of 1 inch to 1½ inch greater thickness of iron than any other target tried.

4. The alleged "facts," that neither shell nor shot had any *penetrating effect*, have no other foundation than the adroit use of the term, "not one penetrated the *armour*," a form of expression which he carefully reiterates, and which is hardly a fair way of putting the case. Mr. Russell means that the projectiles did not pass through the structure. "The *armour*," he says, "was not penetrated;" but the destructive effect was worse, for the ship's skin and frames were crushed and broken in. If a wall be thrown down, the damage is greater than if a hole be broken through it. The backing which supports the plates having yielded, the shots had done their work, and could do no more, and this *fact*, which did occur again and again, notwithstanding the additional thickness of iron, is the strongest proof of the weakness of the system.

The unfair application of the term "pene"trated," is exemplified in describing the effects of the Warrior target, in alluding to which Mr. Russell uses the same term, "penetrated the "armour," when he is only referring to the 4½-inch outside plates. So that in his own case, "armour" means the entire structure of solid iron 8¼ inches in thickness, in addition to the ship's frames and angle irons; but in the Warrior case it means only the outer plate, or 4½ inches of iron. Is this meting with the same measure? Is this the way to state facts?

5. The assertion that the inner skin of his target was not penetrated is unaccountable, for large pieces were broken and crushed inwards by several shots. But here again is the same reticence in using the word "penetrate." Mr. Russell, no doubt, will exclaim—"Oh! I know "the skin is fractured; but I mean the shot did "not pass through." Let him have the benefit of that explanation.

6. The extra weight of armour on this system is not denied; but it is oddly contended that the ship will be lighter. This is not a fact, but an assertion relating to a theory not yet proved or tried. It is the inventor's opinion, which, until a ship is built on his plan, is not evidence.

The inventor seems not to understand the principles of his own invention, or he would not conclude his statement as he does by terming his fastening the "best he has seen," when really it is the worst which has been tried—for this reason, "it causes the destruction of the "armour which it is intended to hold together."

I can only account for the erroneous impression made on Mr. Scott Russell by the experiments on his target by supposing he looked at the apparent effects on the face of the target, and did not observe the effects behind. The space at the back of the target was awkward to get at, so narrow that a man can hardly squeeze himself into it, and so dark it could not be properly examined without a lantern.

I have to correct a mistake in my last letter in describing the effect of the 156-pounder shots on the Warrior target. The charges of

60 lb. and 70 lb. there mentioned were used in proving the gun. The largest charge in firing at the Warrior section was 50 lbs. But the argument is not affected, for on referring to the report of the experiments when her skin plate and frames were broken in, I find that this effect was the result of two 156-pounders fired at the same place. The first fractured the outer 4½-inch armour-plate; the second, hitting the place fractured, met with little or no resistance, and passed through the target; so that in fact the advantage to the gun was greater than if it had fired a single shot with a heavier charge. But every 156-pounder shot fired at the Scott Russell target caused the fracture not only of the 4½-inch plate, but of the 3-inch iron backing plates, as well as of the ship's skin plate and frames.

These details may be tedious to those who do not take a deep interest in the question, but they are of national importance, for they help to establish the truth on a point affecting the efficiency on the day of battle of our iron clad men-of-war. They also illustrate the distinction I wish to establish between the "penetrating and the crushing effects of projectiles."

The damage sustained by this target I attribute in every case to the "crushing effect." The defects of the system, which I have minutely described, are such positive sources of weakness that the structure at the back of the armour plates opposes no adequate resistance to the projectile force. At the moment of impact, this force produced its effects on the weakest points, which, as I have explained, are the T iron frame bars which hold the edges of the plates. They are only an inch and a half in thickness; they are fastened with rows of rivets, producing the same effect as the perforations in a sheet of postage stamps, and the outer holding surfaces are exposed to the impact of shot, and the immediate effects of the shock and jar of the blow. To adopt Mr. Scott Russell's phraseology, "we all knew these "were the weak points of his system, which "could not resist, and, therefore, ought to give "way to heavy projectiles, and we were not "disappointed."

The force expended itself in destroying the fastenings and fracturing the back supports. The structure itself was broken into; hence the shot did not meet with that kind of rigid resistance from the armour plate which would bring its penetrating force into action. But, aided by the cavities at the back of the armour plates, and their looseness in the frames, the projectiles, as you stated in your report, cracked the 4½-inch plates as if they had been "panes "of glass." But since the day of trial, a new *fact* has come to light. The cone of the 156-pounder shot, which was buried in the largest plate—3 feet 4 inches wide—has been extracted, and the plate is found to be penetrated through and through. Here, then, goes Mr. Russell's theory that wide plates resist better than narrow plates.

According to my view, and taking what I conceive to be the precise meaning of "penetrating effect," no iron plate 4½ inches in thickness has yet been *penetrated*. Plates of that and of greater thickness up to six inches, and layers of plates, forming a total thickness of 12 to 15 inches of solid iron, have been fractured, broken through and smashed by projectiles fired singly or in salvos; but in every case these damaging effects have resulted from the backing or the structure behind the plates having given way, or from there being no backing at all. These effects, then, I attribute to the crushing effect of the shot, which, meeting with no sufficient resistance from the structure or material which [supported the armour plates, forced their way into or through the iron. I know of only one example of a fair trial of the "penetrating effect." It is that of the intelligent comparative experiments on elastic and rigid "backings," made by the Iron Plate Committee last summer. Four small iron plates, four feet by two feet, and two and a-half inches in thickness, were fixed side by side, with four different kinds of backing. One was cork and kamptulicon, representing extreme elasticity, another was solid oak three feet thick, a third was a block of granite of the same thickness, and the fourth was blocks of cast iron. The plates were fastened with through bolts at the corners, secured behind to railway bars with nuts and screws. A 40-pounder solid shot was fired with the same charge at the four plates. The effects were as follows:—The plate with an elastic backing was smashed and fractured like a pane of glass through which a stone is thrown; the shot passed through and through the backing, and made its exit behind. The plate with an oak backing was broken much in the same manner, and the shot buried itself in the strong timber, which it crushed into small shreds. The plate with a granite backing successfully resisted the shot, which produced no crack or flaw in the iron, and left only an indentation about three inches in diameter, and three-quarters of an inch deep; but the granite was split. The plate with a cast-iron backing repelled the shot even more successfully; neither the plate nor the iron blocks suffered the slightest injury, and the indentation was less. These results speak volumes; they exemplify what I term the "penetrating and crushing effects." The results in the two first cases were produced by the crushing force; the results in the two last cases prove that when the crushing force is resisted, the penetrating force of projectiles against armour plates is greatly restricted. It is iron against iron—two bodies made of the same material, which, coming in collision with great force, the smaller ought to be destroyed by the larger. It is the case of the punch and the boiler plate referred to in my last letter. I cannot understand why experiments with plates of greater thickness on a rigid backing supported by a structure of sufficient strength to resist the "crushing effect" have not been tried. I leave these facts to speak for themselves, and I trust some of your readers, more familiar with these questions than I am, will take up the theory I have advanced. If sound, I should like men of science who have studied the strength of materials to calculate what ought to be the effect of a ball of iron against a plate of iron fastened to a structure on which the crushing force would produce no effect. If the theory is a fallacy, let it be refuted on scientific principles. A Civilian.

DWELLINGS FOR THE INDUSTRIAL CLASSES.

At the Social Science Congress, on Monday last, Mr. James Mortimer, of Gresham-street, read a paper on this subject. The following are extracts from the paper:—

Architecture to be useful and philanthropy to be of value, for all who can only pay for a two, three, or four-roomed dwelling, must distribute as much good to as many recipients at as little cost as possible, in order that expense may not prevent you from carrying out your plans extensively, or deter others from following your example, and whenever this rule is departed from, such attempts are not only valueless to the industrious classes at large, but absolutely injurious, hence the various Model Dwellings built in this and all other countries are never, to any extent, carried out by the building trade, who look upon them as models not to be copied.

The extensive buildings erected in various parts, by philanthropy or with a view to profit, have not yielded a sufficient return, on account of their expense, to induce capitalists or the trade to follow the example; also, not being so generally convenient or acceptable as houses will be of the common dimensions with gardens, embracing all the comforts and more suitable to the feelings of the community, by not having the barrack appearance, besides affording instances that the only way capital can be employed, to any extent, in building houses for the masses, is to build such as will pay better than those intended for other classes.

I have completed a series of plans for laying out streets and building houses, arranged with a view to perfect ventilation and separation of families, with approved appliances experience has taught essential, adapted to their tastes and wants, offering to the philanthropist an available medium of conferring on the invalid, the aged, and the poorly paid operative or seamstress, an inestimable boon; and to the capitalist a highly advantageous investment; for the well paid, but badly housed mechanic, labourer, and others, would gladly continue their present rental which gives 12 per cent. on capital judiciously expended.

LAMP AND APPARATUS FOR OPTICAL TELEGRAPH.

At the last meeting of the Franklin Institute for the state of Pennsylvania, Mr. L. O. Colvin exhibited the lamp and apparatus of an optical telegraph, patented by himself and G. H. Gordon, March 11, 1862, and remarked, that a light made to appear and disappear, corresponding to the dots and dashes of Prof. Morse's telegraphic alphabet, can readily be used as a means of communication as far as the light can be seen, the distance depending upon the strength of the light used. But in order to make telegraphing in this manner *successful*, certain things are essential. A strong, regular light must be produced, and so arranged that the light be made to appear and disappear suddenly and with ease in signalling the letters.

The invention combines a lantern and reflector, provided with a shutter operated by hand or by electro-magnetism. The lantern is built to produce the best possible light from the substance consumed, protecting the flame from outside currents of air, retaining the heat by the use of plaster of paris, and also supplying the burner with a constant and copious quantity of air; the whole tending to secure the most perfect combustion. The brilliant light thus produced is used to the greatest possible advantage; the best rays of light proceeding from any flame are the direct rays and those adjacent; these are secured. A reflector made in the shape of a horn or funnel is placed wholly in front, with the small end to the light; the direct rays pass through unobstructed, while the reflected light is reflected so near its source and bent so little from its direction as not to diminish its intensity. The real light appears in the centre, encircled with a perfect halo of reflected rays, throwing in front a light the full size of the large end of the reflector, appearing at a distance like a perfect ball of fire. Having the cut-off, as you see, at the small end of the reflector, it becomes very easy to expose the light to view in making the signals with facility—since the shutter is so small and light, and the distance it is necessary to move it is so short, being only to uncover the size of the flame—thus gaining the advantage of a large light, though working a small cut-off, which could not be done by any other style of reflector. By this construction the letters can be signalled perfectly,

o *p* *t* *i* *c* *a* *l*,
(· ·) (·····) (—) (··) (···) (·—) (——)

and read with all ease by any telegraphic operator. The shutter can be easily worked by hand or better by electricity. An electro-magnet placed so that its armature, attached to the lever of the cut-off, by being attracted to the magnet, opens the shutter; by making and breaking the curren with the battery, the light is exposed to view as desired. Thus making it still more easy to operate, telegraphing by light becomes the same in operation as by the common telegraph. The lantern thus constructed can be placed at any convenient position—the mast-head of a ship, top of a tree, or tower of a lighthouse—and worked from below at the pleasure of the attendant. Another operator at a distance reads the letters as they are signalled, and copies down the message.

There is no difficulty in telegraphing secret messages. If you remove the vowels from a page of reading what can you make of it? Nothing. Our plan is to arrange the letters *a e i o u w y* in a table, with figures to represent them; the arrangement can be used 49 different ways, and can be changed at any time. Used in this manner, write off the dispatch, make the substitutions, and give it to the operator; it is sent and received as given, and taken to the person for whom it is intended; he having a key, makes the substitutions back again, and reads the message—the operators knowing nothing of the import of the message they have telegraphed. *Optical* by one substitution might appear thus: 4pt2c5l.

Light in many respects is as well adapted for telegraphic purposes as electricity; it is as fleet in its journey, and with an apparatus constructed to suit its nature, it will do its work as rapidly and distinctly. By this plan a system of communication can be established along our whole coast *via* the ships of war and the lighthouses, by which messages may be sent and received from any portion of our blockading fleet every night, with just as much certainty and despatch as if a cable connected the different points and the electric flash conveyed the intelligence.

GOLDMINING AND THE GOLD DISCOVERIES MADE SINCE 1851.

(Concluded from page 348.)

ASSAY OF ORES CONTAINING GOLD.—Minerals containing gold are in most instances assayed in precisely the same way as those affording silver.

To make an assay of auriferous quartz, the sample to be operated on is first finely pulverised, and a given weight subsequently well mixed with litharge, carbonate of soda, borax, and an amount of charcoal dust sufficient for the production of a button of lead of a convenient size for cupellation. The metallic globule remaining on the cupel after this operation will contain all the gold present in the ore, together with any silver that may be associated with it, as well as certain minute portions of that metal derived from the lead of the reduced litharge.

In the case of the poorer ores, containing less than 10 dwts. of fine gold to the ton, the silver derived from the litharge will frequently be found amply sufficient for the purposes of inquartation, whilst for the richer varieties the addition of a little pure silver at the time of placing the button on the cupel is often necessary. When, in addition to gold, the ore contains small quantities of iron pyrites, or other sulphurised mineral, it not unfrequently happens that the admixture of charcoal or any other reducing agent becomes unnecessary, and the fusion may be made with litharge alone.

When, however, pyrites, blende, or other metallic sulphides are present in large quantities the sample must either be treated by scorification or it must be first roasted until all the smell of sulphur has disappeared, and then treated as in the case of substances not containing that body, but with the addition of a large proportion of borax. It is, however, to be remembered that when any of these compounds contain sulphur, it is of importance that the whole of it should be removed either before or during the process of obtaining the leaden button, since otherwise, and particularly in the presence of alkaline fluxes, a portion of the gold may enter into combination with the slags in such a way as not to be entirely parted from them by the action of metallic ad.

It may be proper to remark here that although nothing is more easy than to estimate with great accuracy the amount of gold contained in any given specimen of gold quartz, it is considerably more difficult to obtain a fair average sample of the usual produce of a vein. When the metal is in a fine state of division, and equally disseminated throughout the gangue, this presents less difficulty; but when on the contrary, it occurs in pockets and irregular deposits, it frequently requires the exercise of great care in order to avoid falling into very serious errors.

It is consequently of the highest importance that whenever ores are to be assayed for gold, the greatest care should be observed in preparing the samples on which the operation is to be conducted. With this view, the heaps or piles should be fairly cut through, two or three tons being taken from each parcel of importance, and reduced to fragments not exceeding the size of beans; this may be effected, when crushing machinery is not available, by breaking the ore by the aid of properly-shaped hammers on iron plates. This operation is technically called "bucking." The ore thus prepared is now to be thoroughly mixed, again made into a pile and again cut through, taking out of it this time from three to four hundred weights, which are reduced to the state of fine powder, either in a large mortar or by grinding on an iron plate. After well mixing, this powder is again cut through, and about 20lbs. weight taken, for the purpose of being still further reduced in size, and passed through a sieve of fine wire gauze. Should any flattened particles of gold remain in the sieve, they are to be carefully collected, cupelled, and parted, and due allowance made for them in the result obtained by direct assay. Of the finely-divided ore which has passed through the sieve, at least six different assays of one thousand grains each should be made, and their mean result taken as representing the produce of the parcel of ore of which it is the object to determine the value.

By operating in this way, almost absolute accuracy may be ensured; but when a less degree of exactitude is necessary, the quantity of crushed ore may be reduced and the number of assays fewer.

If after thus accurately testing the produce of a parcel of ore, it be passed through the most efficient crushing and amalgamating machinery with which we are acquainted, it will be found that the total amount of gold originally present in the stuff is never obtained, and if this deficit be sought for in the tailings resulting from the operation, it will be discovered that a certain small quantity of the precious metal still remains unaccounted for. This deficiency would appear to be due to the circumstance of minute particles of flattened gold having floated off on the surface of the water, and frequently amounts to nearly two dwts. per ton of ore treated.

When the ore to be examined contains silver in addition to gold, and it is desirable to ascertain its amount, it becomes necessary first to cupel the button of lead without the addition of silver; the metallic globule thus obtained is weighed and its weight noted, deduction being made for the weight of silver derived from the reduced litharge, which must be ascertained by a distinct cupellation. If more siver is required for the operation of parting, it is added, and the button, together with the fragment of silver, is enveloped in a piece of pure lead foil, and again cupelled. Lastly, the resulting globule is dissolved in nitric acid, and the gold weighed. The weight of silver present in the ore will consequently be represented by that of the button of alloy obtained from the first cupellation, less the united weights of the gold and the silver resulting from the reduced litharge.

In concluding this subject I cannot better express the great importance of obtaining fair samples than by quoting the words made use of by Dr. Percy, in a lecture delivered in 1852, at the School of Mines, who, when speaking of gold assays, said, "Above everything be particular in obtaining an honest and fair sample. This is a matter of paramount importance, and of no small difficulty in many cases, but let there be honesty of intention and this difficulty will be generally surmounted."

GOLD MINING SPECULATIONS OF 1852.—Shortly after the discovery of the gold deposits of California and Australia, numerous associations were organised in the United Kingdom for the purpose of working gold mines in those countries, and I regret to say that, in almost every instance, these have resulted in the total loss of the capital so embarked.

Various circumstances have contributed to produce these disastrous results, but none more so than the fact that, in too many instances, sufficient attention had not been paid to obtaining samples fairly representing the average produce of the various veins which it was intended to work.

The specimens which reached this country were often picked samples, and on being placed in the hands of the assayer yielded a produce which was far from realised when fair average samples of the leads came to be tested on a large scale. Then, too, it was not unfrequently found that quartz veins, producing what should have been a remunerative amount of the precious metals, were situated in localities in which, either from the want of water or some other cause, their exploitation was attended with extraordinary difficulties. And, above all, the excessive price of labour, and all other mining requisites which then prevailed, was, inmost cases, a sufficient barrier to anything like remunerative returns to the proprietary.

It is sufficiently evident that, in a country where an egg sells for a shilling, and a fowl for a guinea, a much larger amount of gold will be required in order to afford remunerative results than in one in which the necessaries of life can be procured at a more moderate rate; and it is also much less difficult to control the labour of a large staff of operatives where employment is comparatively scarce, than where any man of moderate industry may, by working on his own account, earn nearly twenty shillings per day; the natural effect of such a state of society being that, in the first place, work of all kinds is necessarily expensive, and, secondly, that the supply of labour is very precarious.

In all rich and newly discovered gold districts, which have for the most part a very limited resident population, the alluvial and easily worked deposits afford for a considerable time a superabundance of remunerative occupation for the newly arrived immigrant, but as these gradually but slowly become exhausted, something more than mere muscular strength becomes necessary in order to keep up the returns, a more systematic method of mining is adopted, a thorough combination of labour and the investment of larger capital are required.

It must, however, be remembered that these changes, although gradual even in a new colony, are infinitely more rapid than those who have always resided in European countries generally imagine. Ten years in the life of a colony, and particularly a gold-bearing one, effect greater changes in its commercial and social relations than a century in an old established country, and we have, consequently, no reason to be astonished that veins are at the present moment being advantageously worked both in Australia and California, when, in 1852, such operations would have been attained by a certain and very considerable loss.

It is a generally admitted fact that veins of auriferous quartz have little or no relation, with regard to the expense of working them, with the more readily worked alluvial deposits in their vicinity. In the one case the rock has to be broken, crushed, and washed, at a considerable expenditure of time and money, whilst in the other, nature has for centuries been carrying on these operations and so preparing the gold as to admit of its extraction by very simple means. It consequently follows that the period at which quartz veins can be advantageously worked in any given locality will not entirely depend on their yield, but

Digitized by Google

will also be more or less influenced by the abundance and richness of the alluvial diggings in their vicinity, and the general price of labour and materials in the district.

The supply and consequent price of labour must also be materially influenced by the distance at which the gold producing countries may be situated from the great centres of civilization. From their remoteness and their consequent difficulty of access, Australia and California for a considerable period offered striking examples of the demand for labour exceeding the supply, but the constantly increasing facilities afforded for travelling, and in some instances their nearer proximity to Europe, will probably prevent this occurring to the same extent in the more recently discovered gold-fields.

There is, therefore, every reason to believe that the amount of gold annually derived from the working of gold quartz will go on gradually and rapidly increasing—and that, by the introduction of efficient and powerful machinery, ores of a very low produce will ultimately be treated with advantage.

These observations particularly apply to the province of Nova Scotia, whose geographical position renders it impossible that labour should ever attain an excessive value, whilst, if a large supply of auriferous quartz can be obtained from the mines of North Wales, it is evident that a very small yield of gold, if continuous, might be rendered remunerative.

The operations of separating oxide of tin from its matrix, and gold from its ores, are in many respects, exceedingly analogous, and consequently the expenses incurred in the one case may (all other circumstances being the same) serve approximately as a guide for estimating the cost which should be incident to the other.

The most efficient apparatus employed in this country for the reduction of ores to the requisite degree of fineness are undoubtedly to be found in the tin mines of Cornwall; and as an example of the expense attending the process of stamping, it may be stated that at Polberro Consols, in the year 1854, a 36-inch condensing engine, working at 55 horse-power, stamped no less than 30,200 tons of tin stuff, at a total expenditure of 1s. 3½d. per ton. Each head stamped, therefore, 420 tons per annum, or 28 cwt. per 24 hours, whilst the whole number reduced 100 tons per day at a cost of 2s. 4d. per horse-power. During the same year the average produce of the stuff stamped was 20¾ lbs. per ton, and the net profit on the operations £2,350 9s. 8d. If we now assume the value of black tin to be 8d. per lb., and that the expense of stamping an equal quantity of gold quartz would have been the same, the total value of the produce obtained from each ton will be 13s. 10d., or equal to a yield of about 3½ dwts. of fine gold.

It must, however, be admitted that the cost of stamping a ton of ordinary gold quartz will be somewhat greater than that of treating an equal quantity of Polberro tin stuff, and that when the gold is in an exceedingly minute state of division, or where sulphides are present in large quantities, the separation of the gold may sometimes be attended with a certain amount of difficulty, but this difference will, in many cases, not be material.

It is therefore evident that when large quantities of auriferous quartz can be obtained, in a country where the price of labour is not high, it is not necessary that it should contain a large amount of the precious metal in order to render its treatment by the aid of well constructed machinery remunerative.

As an instance of the very small yield which, under peculiar circumstances, may be rendered available, I would adduce the fact that at Schemintz, in Hungary, in the year 1842, the total quantity of ores stamped was above 40,000 tons, and the average of the useful metals extracted from 50 tons was—gold, 3 oz.; silver derived from the separating process, 3¾ lbs.; lead similarly obtained, 8½ cwts.; the ratio of the gold to the other materials being here as one to half a million. It is also important to state that in this instance the ores had to be broken from solid lodes, at depths extending to 200 fathoms from the surface.

MR. MONCKTON MILNES ON THE INTERNATIONAL EXHIBITION.

On Friday, May 2nd, Mr. Monckton Milnes, M.P., delivered an address before the Royal Institution, on the International Exhibition of 1862. The speaker stated that the Managers of the Institution had arranged that some discourses should be there delivered, on the most important natural products to be exhibited at the Great International Festival, and had thought it advisable that these special addresses should be prefaced by a few considerations of the nature and scope of this wonderful congregation of the industries and intelligences of the world. He was much flattered at being selected to perform this duty, and could assure the members present that he should come into no competition with the eminent persons that would follow him, but should confine himself to those generalities and common-places, which are not always the more displeasing for being in some sort the reflection of their own minds.

It was the habit of this Society to deal rather with facts than speculations, and he would therefore direct their attention to the geographical and political conditions which alone rendered possible such an event as this. It had been written with sufficient accuracy for verse, that—

"The total surface of this sphered earth
Is now surveyed by philosophic eyes:
Nor East nor West conceals a secret worth—
In the wide ocean no Atlantis lies:
Nations and men, that would be great and wise,
Thou knowest, can do no more than men have done;
No wond'rous impulse, no divine suprise,
Can bring this planet nearer to the sun—
Civilization's prize no royal road has won."

The accessibility of the ocean-waters of the globe was a first necessity to this end, and this had been now accomplished from the ice-bound fires of Mount Erebus to the grave of Franklin. We could not say quite as much of our knowledge of the land of the world, but we perfectly understood the limits of our ignorance, and could fairly assume that there was no position on the earth yet unsurveyed which could in any notable degree add to our physical science, or extend our observation of the habits and destinies of mankind.

Although great continents are represented in our Exhibition only by their fringes, we can hardly contemplate any such conversion of nature or man as should people the sandy spaces of Africa, the vast pastoral steppes of central Asia, or those huge fields of the unlimited liberty of animal and vegtable life which stretch in South America from the tropics to the polar snows, with the higher forms of industry, art, and civilization. It is enough that no longer can Tartar hordes swoop down on richer and fairer lands, and that the sage and saleratus prairies of North America cannot check the enterprising outgrowth of the Anglo-Saxon race.

And this brings us to another necessary condition of our Exhibition, the security of the seas and the general facilty of our commercial intercourse. The exceptional piracy which obstructs the trade of the waters of Oceania, and which the energy of Sir James Brooke has done much to repress, was once the custom of the world, and carried with it no notions of cruelty or disgrace. This evil was partially remedied by placing commerce under the safeguard of religion. Where the modern state establishes a factory or a free port, the old state built a temple. Thus the Tyrian Hercules linked together the trade of Greece and Phœnicia in a common worship: thus the fane of Jupiter Ammon was the great resting-place and protection of the caravans of the desert: thus the lines of the chief Catholic pilgrimages were the paths not only of all travellers but of all merchants in the middle ages. The interchange of the gifts of God was sanctioned by Pagan and by Christian piety, and the notion of connecting trade with any inferiority of social station or intellectual power is a perverted remnant of the feudal system where the jealousy between town and country tended to discredit labour and to idealize brute force.

The speaker proceeded to draw the distinction between ancient and modern trade. In the old Asiatic nations, where influence is still palpable among mankind on the score of authority and the bond of religion, the ideas of free trade and competition would have been incomprehensible. The exclusion of foreigners from the internal navigation of the several countries was universal, and none were permitted even to enter foreign ports, except with the *tessera hospitalis*, or some other symbol of a commercial treaty. Bars were thrown across the mouths of some rivers, as by the Persians across the Tigris after their conquest of Babylon; traces of which impediments to navigation still remain. And in modern Europe the growth of liberal commerce has been slow indeed, and it is one of the happiest privileges of our time, that as regards ourselves at least, we have come to see its consummation. In Sir Dudley North's "Discourse on Trade," published in 1691, the principle is laid down "that the whole world as to trade is but as one nation of people, and therein nations are as persons." But the Hollanders and the Portuguese long remained the objects of a commercial animosity, which did not prevent the one from occupying our fisheries up to the very coast, and the other from sharing with us the dominion of India.

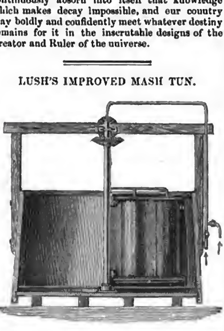
The social and political conditions represented by our Exhibition next occupied the attention of the speaker. The whole of this marvellous combination of energy and art is the result of free labour—of the spontaneous industry of mankind. It is not the mere application of local nature to local designs, but the collation and transmutation of most diverse and distinct elements to the use and benefit of our race: the juxta-position of our coal and iron have suggested the manufactures of Sheffield, but it is the borax of Tuscany which assists the ingenious labourers of Colebrooke Dale. It is the sign and symbol of the general education of the world, which renders it impossible that discoveries can be neglected or arts be lost. The ignorance and superstition which kept mankind in unnecessary physical pain after the invention of the "spongia somnifera" of the 12th century, can no longer check the annæsthetic powers of a beneficial nature, nor would it require a Harvey to revive, however he might be required to develope, the knowledge that perished with the ashes of Servetus.

But besides the intercommunication of nations in space, the speaker remarked, our Exhibition surely owes much to what he would call the trade of time, the thoughts, the feelings, the interests, that pass from generation to generation; the arts of Greece, the laws of Rome, the religion of the Semitic peoples, the triple elements of modern civilization. The silent East gave the alphabetic character which has transmitted all the speeches and varied literature of the West; the Brahmin preserves the sacred language in which the linguistic science of modern times traces the mother-tongue of all the Indo-Germanic dialects that pass from mouth to mouth beneath these lofty domes.

The singularity of the circumstance that England should be the scene of this meeting of the nations was next alluded to. It was an illustration of the advantage of our insular position, which being combined with sufficient territory, gave us at once the best political conditions of external power and domestic independence. Our greatest danger in history has been not our own conquest, but the conquest of France, which must have absorbed us into the continental system. Now, the peril of our power lay in the rapid political and moral elevation of the other European nations, but we could well afford to sacrifice some individual superiority to the common gain of mankind.

The speaker concluded with noting some of the probable effects of this great jubilee of commerce. Large congregations of men had always vividly struck the imagination, and the jubilee of Pope Boniface so occupied the mind of Dante that he illustrates by it one of his supernatural pictures, and fixed it as the date of his spiritual journey. Such assemblies have always been looked on as harbingers of peace, and we know what were the expectations of 1851. But though that hope has proved delusive, we may yet feel thankful that, with the exception of the American calamity, all the disturbances of the world since that time have been the conflicts of a lower against a higher civilization, in which the higher has had the mastery. The materials here brought together must impress on the spectators the mutual dependence of nations, and the interests of amity. One of the chief objects of interest would be the various applications of art to industry; advantages perhaps somewhat balanced by the injury of the application of industry to art. As art becomes mechanical, it loses the spontaneous dignity which makes it most divine, and it seems impossible to diffuse and repeat it, without some diminution of its highest faculties. But this qualification does not extend to the relations between industry and science, there the moral is as certain as the material profit; intelligent labour is substituted for the mere exertion of brute strength; the supply of comforts is extended from the luxurious classes even to the necessitous: the diseases consequent on physical hardships are diminished, and the average longevity of man increased. To the progress of scientific education not only the philosopher but the statesman looks for the diffusion of public happiness and the permanence of modern civilization. If the states that now rule the world are to escape the doom of Babylon and Rome, of Egypt and of Greece, it is in that they have not made their science the monopoly of a caste or a priesthood, but they have placed it more or less within the reach of the individual intelligence of the humblest citizen. Let the education that enables mankind to apprehend and value truth proceed commensurately with the discoveries of science, and the community will gradually but continuously absorb into itself that knowledge which makes decay impossible, and our country may boldly and confidently meet whatever destiny remains for it in the inscrutable designs of the Creator and Ruler of the universe.

LUSH'S IMPROVED MASH TUN.



Mr. Lush, Brewer, of St. George's Square, Portsea, has patented an improvement in mashing attemperators. The object is to avoid the injurious effects of what are known in brewings as "raw worts," by which much of the useful portion of the malt is lost, and the quality of the beer is deterio-[illegible] this is obviated by the use of the "tun" above [illegible] which raises the temperature of the [illegible]quired heat, and retains it at such temperature as long as may be required, and in a manner which produces no damage to the mash, as is the case with most, if not all, the mashing attemperators at present in use.

For the purpose of carrying out these improvements, an upright shaft is fixed in the mash tun which is carried at the top by suitable bearings, and at the bottom by a shoe or step fixed in the bottom of the mash tun; the shaft is caused to revolve by gearing, driven by any motive power, and it is made hollow for a portion of its length to carry the steam and water required in using the attemperator; to this shaft one or more arms are secured placed at right angles to the upright shaft. These arms carry copper vessels of any suitable shape. The vessels are filled with heated water up to a point indicated by a gauge cock fixed in the side of the vessel; they are furnished with a safety valve to remove any superfluous pressure, and a thermometer to indicate the temperature of the water in the interior of them. Each copper vessel is furnished with a pipe descending from the top arm nearly to the bottom inside of it, and connected with a regulating cock to the upright hollow shaft. The top of this upright hollow shaft is furnished with a stuffing box and gland forming a joint for the pipe or pipes supplying steam or water, as required, to the attemperator,

MATTHEWS' APPARATUS FOR CONVEYING LINES TO WRECKED VESSELS.

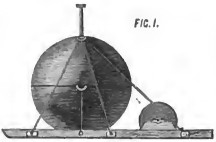
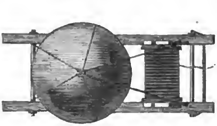


FIG. I.

FIG. 2.



Mr. W. E. Matthews, of Sea View, Isle of Wight, proposes to convey lines or other medium of communication for the purpose of obtaining assistance in case of shipwreck, by means of an apparatus which consists of a cradle or frame, constructed of wood or other material. At one end of the frame a reel is secured, as represented, which, running on a spindle, has at the same time a line reeled round it, which runs off from the under parts of the reel and through a brass or copper eye attached to a small rope; this eye may be shifted at pleasure from the centre to either side of the frame (inside), to act as a directing power, if required, whilst to the fore part of the frame a gutta percha, indian-rubber, or other ball or balls of a light and powerfully buoyant nature are attached, which being acted upon by the wind and sea, carry the line and cradle away, the line relieving itself as the apparatus moves through the water by the force of the wind, or of the wind and sea combined, on the ball or balls. The apparatus may, by enlargement, so as to secure adequate buoyancy, be made to carry a man (or other weight) from the ship to the shore.

LEMOINE'S APPARATUS FOR FORMING PIPE JOINTS.

Fig 1.

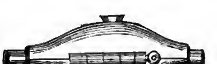


Fig. 2.

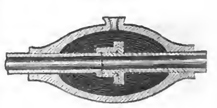
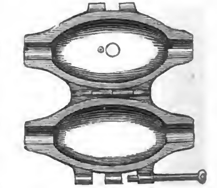


Fig. 3.

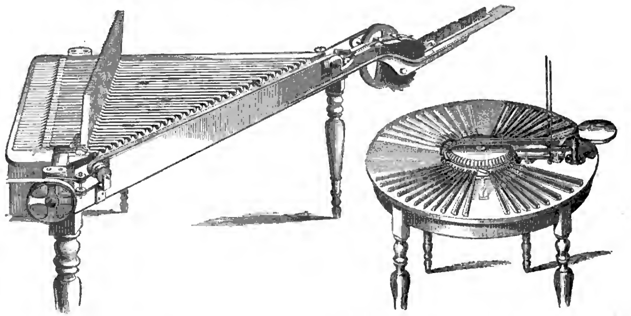


The object of this invention, patented by Jules Lemoiné, of 34 Rue Saint Paul, Paris, is to obtain a joint formed with a view to prevent or resist leakage or waste of the gas or other matter conveyed through the pipes or tubes. For this purpose a box is placed or fitted over the joint junction or nearest ends of the pipes or tubes, into which box is introduced a cement or other substance, hereinafter called the sealing agent; after which the box is sometimes removed, but sometimes left on. It is preferred to form the box in two or more pieces, connected by hinge joint, binding ring, or otherwise, and to keep it in place on the pipes or tubes by collars, and to furnish it with a screw or other instrument for closing or tightening it; and to construct it with an opening for admitting the sealing agent.

It is mostly desirable to form the box with ends or necks fitting closely round the tubes. The sealing agent may sometimes be applied to plaster or coat the outside of the box, or to close it where its necks or ends surround the pipes, either instead of or in addition to the introducing of the sealing agent within it. The mechanical joint or pipe end perferred is a socket, fitting the end of one pipe, which is formed with a collar, entering a mouth or socket formed at the end of the other of larger diameter than the body of the pipe, and terminating in a flange.

The sealing agent that is adopted in many cases is sulphur in a state of fusion, alone or mixed with peroxyde of iron, or with red or yellow ochre, or other ingredient, and at a temperature of at least 170° centigrade; but other substances may be used for "sealing," such as lead, tin, alloys, and metallic amalgams, resins, gums, pitch, gelatine, alumina soap, gum lac, copal, melted metallic salts, caoutchouc, gutta percha, vegetable and marine glue, and other matters alone or combined with other ingredients.

MITCHEL'S PATENT TYPE-COMPOSING AND DISTRIBUTING MACHINES.



MITCHEL'S PATENT TYPE-COMPOSING AND DISTRIBUTING MACHINES.

In order thoroughly to demonstrate the practical utility of these machines, they are employed in the International Exhibition, Class 7, B, Machinery Annex, in the actual performance of work for the press; one machine is for composition, and another for distribution.

The "compositor" is in shape a right-angled triangle, placed horizontally, with a key-board at one of the sides, furnished with thirty-nine keys. Each key, when pressed, strikes out a type from one of an equal number of brass slides standing at an incline upon the machine in a row nearly parallel with the key-board. The type thus liberated is conveyed upon a band, moving in a direction at right angles with the key-board, to another band (forming the hypothenuse of the triangle) which carries it on to its destination. Arrived here, it is placed on end and pushed forward, to make room for the next type, by means of a notched or serrated wheel called the "setting wheel." The words are thus put together with great rapidity, in a long line of about thirty inches, which is afterwards divided by the compositor into lines of the required length.

The principle of the machine consists in the combination of bands of lengths and velocities of revolution so varied as to enable the types, at different distances from the wheel, to reach it in the order in which the keys are struck.

The "compositor" is capable of setting up types at the rate of 6 letters per second, or 21,600 per hour; but as the human fingers cannot attain to such rapidity, and allowance must be made for the operations of "justifying" and "correcting," the work of an average trained operator will probably not exceed 24,000 or 25,000 ens per day, which is about equal to the work of two men setting up type in the ordinary mode. As each machine can employ two operators, the daily production is about 50,000 ens.

The "distributor" is a small machine of circular form. The lines of type to be distributed are placed successively in a long channel, in which they are pressed forward towards a vibrating metal "finger." By this finger each type is separated from the line, pushed aside, and dropped on to a grooved brass wheel revolving horizontally. In the grooves of this wheel pins are placed, on which the types are hung by means of nicks, the ends of the types projecting below the under surface of the wheel at distances varying according to the position of the nicks. As each letter arrives over its receptacle it is lifted off its pin, and dropped into its place, being pushed a little forward to make way for the next arrival. When the line is filled in this way, it is removed by the boy to the "compositor." The "distributor" is self-acting, and requires only the attention of a boy. It distributes 8,000 letters per hour.

Both machines have been successfully used with type ranging in size from great primer to brevier. They have been worked for several years in America, and have been recently introduced into the establishments of some of the most eminent printers in England and Scotland. As compared with the present mode of type-setting, the following advantages are claimed for these machines:—1. An economy of labour varying from 30 to 50 per cent., according to the character of the work. 2. Greater facility in acquiring the printer's art, whilst it renders his occupation comparatively light and healthy. 3. Decrease in the wear of type, and a smaller quantity sufficient for a given amount of work.

COAL AND BRITISH INDUSTRY.

An interesting lecture was lately delivered at the Royal Institution, by Mr. Warington Smyth, "On Coal as one of the great Materials of British Industry," on which occasion the Duke of Northumberland took the chair. After remarking on the great importance of coal, socially and politically, as the chief source of the manufacturing superiority of this country, Mr. Smith proceeded to consider its formation, character, and geological relations. He said that though doubts were at one time entertained whether that hard, black, and heavy mineral substance could have been formed from vegetable matter, these doubts have been entirely removed by the abundant fossil remains of trees and plants found in the shales above and beneath the seams of coal, and in some instances in the coal itself. The "coal measures," or series of strata among which coal occurs, consists of successive layers of sandstones and shales, or indurated clay, intermixed with occasional layers of coal, which vary in thickness from less than the eighth part of an inch to ten or twelve feet; few of those seams of coal that are less than two feet thick being at present worth the expense of working. In the shales above and below the coals are generally numerous fossilised plants of great variety, and Mr. Smyth said that on one occasion, after having wisited the fine collection of tropical plants at Chatsworth, he descended into a coal mine, on the roof of which he witnessed a collection of tropical vegetation that even surpassed what he had seen a few hours before in the Duke of Devonshire's conservatories. In the shales underneath thick beds of coal are found abundant remains of a plant called "sigillaria," which are supposed to be the roots of large trees known as stigmata, many of which are upright as they grew, and their trunks pass through the coal into the shale and sandstone above. These plants, and indeed all the fossil vegetation associated with coal, belong to genera that now grow in tropical climates, though none of the same species are extant. The accumulation of vegetable matter at the present day in peat bogs, Mr. Smyth observed may be regarded as an illustration of the manner in which masses of vegetation were collected during the period of the coal formation, and which it must be supposed were subsequently converted into coal by the action of heat and superincumbent pressure. The fact that large fossil trees, apparently springing from the roots below the seams of coal, penetrate into the rocks above, indicates the rapid deposition of the sand and clay above the vegetable matter, for the strata must have been deposited before the still distinctly vegetable organisation was decomposed. The stems of trees which thus pass through the shales above the coal are not unfrequently the cause of fatal accidents in coal mines, for when the coal has been extracted, the upper parts of the fossil stems having lost their support, fall into the passages of the mine, and the men who are working below are severely injured. Mr. Smyth stated, that in one of the coal mines he inspected the fossil stems of the trees had fallen from the roof in many places, and he saw several still there that might fall at any moment. The relative extents of the coal districts in England, Wales and Scotland were marked on a large map; but, as Mr. Smyth observed, the superficial area gives a very imperfect idea of the quantity of coal beneath, for the depths of the coal measures vary considerably, and the thickness and value of the seams of coal they contain vary much more. The depth of the Northumberland and Yorkshire coal measures is about 2,000 feet, and the total thickness of the coal in the various seams is fifty feet. The coal measures of Staffordshire are 5,000 feet deep, and they contain a total thickness of 100 feet of coal; while in Westphalia and at Starbruk the coal strata extend to depths of 6,000 and 10,000 feet. In addition to the principal beds of coal which lie above the carboniferous limestone in the geological series of rocks, there are others of much less thickness and of minor importance, c sionally found below and among the carboniferous limestone, sometimes in the secondary strata, and more abundantly in the tertiary formations. The latter kind of cool is often called wood-coal, as it is of a brown colour, and not perfectly mineralised, and it contains very distinct indications of its vegetable origin. It is a remarkable fact that the character of the vegetation of the wood-coal found in Germany closely agrees with the vegetation of North America, and not with that of Europe, from which Mr. Smyth inferred that at no very distant geological period Europe and America were united, for it is not probable that the vegetable matter could have floated across the Atlantic and been deposited in Germany. It is from such facts as this that geology is enabled to throw light on the geography of former worlds.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS,

(Concluded from page 380.)

ELECTRICAL TESTS.

THE second paper read was "On the Electrical Tests employed during the construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables," by Mr. C. W. Siemens, M. Inst. C.E.

Having been employed by Her Majesty's Government as the Electrician to superintend the manufacture and shipment of the Malta and Alexandria telegraph cable, the author was in a position to speak as to its actual state of insulation, at different stages of its progress, and as to its general superiority compared with former lines. The methods of testing differed essentially from those previously resorted to. This was the first line that had been tested systematically throughout; and the importance of a uniform and well-devised system of electrical tests being carried on during the manufacture, shipment, laying, and subsequent working of submarine cables, had been fully proved.

The covered strand of conducting wire, in lengths of one nautical mile, was placed for twenty-four hours in tanks filled with water maintained at 75° Fahrenheit. It was afterwards removed into a pressure tank, containing water at the same temperature, and when uniformly heated, it was tested for conductivity and insulation, and the result, expressed in units of resistance, noted. A pressure of 600 lbs. per square inch was then applied, and the electrical tests were repeated. Before any coil was approved, it was required that the copper resistance should not exceed 3·5 (Siemens) units, or possess 80 per cent. of the conductivity of chemically pure copper; that the gutta percha resistance per knot at 75° should amount, at least, to 90 million units, corresponding to about 80 per cent. of the highest insulation that could be obtained with the best gutta-percha of commerce; and further, that the insulation should improve when the pressure was applied, which was invariably the case when the covering was sound. The coils were then transferred to Messrs. Glass, Elliot, & Co.'s works at Greenwich, where they were submerged in tanks until required for the sheathing machine. The sheathed cable was coiled into large tanks, and was always intended to be covered with water, but owing to a defect in the construction of the tanks, this regulation could only be partially carried into effect. It was also intended, in the first instance, that the ships should be provided with water-tight tanks to receive the cable during the outward voyage; but owing to the passive resistance with which every deviation from previous routine was usually met, this plan was not carried out, until the heating of the cable on board the S. S. Queen Victoria had proved, at great cost, that tanks were essentially necessary. There were other important advantages obtained through the adoption of the water tanks by which the causes of failure in paying out were avoided, and the operation was rendered comparatively safe and easy.

In conducting the electrical tests of the Malta and Alexandria cable in the course of its manufacture, the chief object was to obtain throughout strictly comparative results. For this purpose it was necessary to adopt a standard measure of resistance, by which to express both the conductivity of the copper conductor and of the insulating covering. This standard measure had been supplied by Dr. Werner Siemens. The unit of resistance was that of a column of pure mercury, contained in a glass tube, one metre in length between the contact cups, and of one square millimetre sectional area, taken at the temperature of melting ice. As the testing apparatus had been already described in the Blue Book "On the Construction of Submarine Cables," it was not necessary to repeat it. In the Appendix to this Paper, tables were given of the results of observations upon two sections of the cable, at various stages of their progress, between Malta and Tripoli, and between Tripoli and Benghazi; and diagrams were exhibited representing graphically these results. On comparing the insulation of the cables after being laid down, with the insulation observed shortly before on board ship, there was a decided improvement after submersion. This was partly due to the pressure upon the cables, the insulation improving 2 per cent. on an average for every 100 lbs. of pressure upon the square inch, and partly to the lower temperature at the bottom of the sea.

For working the line, Messrs. Siemens, Halske, and Co. had supplied ink-recording instruments, fitted with peculiar arrangements for discharging the residuary charge of the cable, and capable of being worked by exceedingly feeble battery power. Although the line was divided into three electrical circuits, messages were transmitted mechanically and instantaneously, at the intermediate station, by a system of double relay, or translation. By this plan messages could be sent instantaneously from London to Omsk, in Siberia, and there would be no electrical difficulty in establishing the same direct intercommunication between London and Calcutta.

Respecting the construction of a cable of a more permanent character than any hitherto made, to which the author had given much consideration for many years, it was observed that with regard to the insulating covering, nature seems to have provided only two suitable substances, india rubber and gutta percha, combining permanent pliability at all ordinary temperatures, with high insulating property. India rubber had a higher insulating power, a lower specific induction, and was capable of resisting higher temperatures than gutta percha; but the latter could be put upon the wire in a plastic state by a dye process, and gave greater security against faults than the lapped india rubber covering. It was also less liable to receive accidental injuries, to become sticky or semi-fluid when exposed to the atmosphere, and resisted the action of water more perfectly.

The absorption of water by gutta percha, india rubber, and compounds of india rubber, such as vulcanised india rubber, Wray's mixture, and a compound with mica, under various pressures and temperatures, and from water containing different degrees of salt in solution, had been fully investigated. These experiments served to show, that an increase of pressure up to 50 lbs. per square inch, did not increase the rate of absorption, which was found to be more rabid from pure water than from sea water, and from sea water than from brine. Raw and unvulcanised india rubber absorbed water in greater quantities than the other materials; while, next to gutta percha, vulcanised india rubber showed, both in fresh and salt water, the greatest insensibility to absorption.

The results of experiments on the insulating and inductive capacities of wires coated with india rubber, in combination with gutta percha, compared with those of special gutta percha and pure india rubber at different temperatures, were then given. The lengths experimented upon varied from 600 to 2,500 yards. The specific resistance of special gutta percha decreased from 9·11 at 50° Fahrenheit, to 1·50 at 80° Fahrenheit, or to about one-sixth of its original value; while the combination of india rubber and gutta percha had, under the same circumstances, only gone down to about one-third of its insulation at 50° Fahrenheit. The inductive capacity of the combined india rubber and gutta percha wire and of pure india rubber covered wire, was as 0·7 to 1. Notwithstanding the comparatively high insulating property of india rubber, its low inductive capacity, and its power to resist heat, its gradual dissolution in sea water was a circumstance which alone rendered it inadmissible for submarine wires, unless it was securely inclosed in another waterproof medium, and gutta percha appeared, in every respect, well suited for such outer covering. It was desirable, that the india rubber should be brought upon the wire without the application of heat, or solvents, both of which often entailed a gradual decomposition of that material, particularly when exposed to atmospheric influence in contact with copper. Dr. W. A. Miller had stated, that the liquefaction was the result of a process of oxidation, from which it might be inferred that the effect could not take place where oxygen was excluded. It, moreover, was important to produce a perfectly cylindrical covering, and taking advantage of a peculiar property of india rubber cohering perfectly where two fresh cut surfaces were brought together under considerable pressure, the Author had constructed a covering machine which fulfilled the several purposes. Such combined india rubber and gutta percha covered wires had been tried under various circumstances exposed to the atmosphere, to water, or the moisture of the ground, for nearly two years without betraying any signs of gradual deterioration of the india rubber, or the appearance of faults. A circumstance greatly in favour of the bi-covered wire was that the gutta percha shrank upon the india rubber covered wire, and when any mechanical injury to the covering occurred, the yielding india rubber was forced into the gap, by the elastic pressure exercised by the gutta percha, and prevented the appearance of a fault.

The outer covering of cables, as hitherto constructed, was certainly the least perfect part. An iron sheathing was very necessary to protect the insulated core in shallow waters, but for cables in more than 30 or 40 fathoms of water, the iron sheathing was an element rather of weakness than of strength. It rendered the cable ponderous, its shipment expensive, the paying-out risky, and repairs impossible, owing to the difficulty of raising a heavy cable from a great depth under any circumstances, and the absolute impossibility of doing so after corrosion of the iron wire had made some progress.

When the Falmouth and Gibraltar cable was first contemplated, the author, in conjunction with Mr. Forde, proposed to cover each iron wire with gutta percha, with a view to prevent oxidation; but the system was not acted upon, except by way of experiment. Mere protection of the wire was, however, not sufficient, in the author's opinion. It was capable of mathematical demonstration, that in paying out a wire sheathed cable, with a considerable strain upon the breakwheel, it would untwist while in suspension in the water to a considerable extent, causing elongation of the core to the amount of, say 1 per cent., or even more. On reaching the bottom, the strain and consequent twist would be released. Copper wire could not be elongated more than 2 per cent. without receiving a permanent set; and it was also a well ascertained fact, that when telegraph core had been stretched at any time beyond the limits of elasticity of the copper, the latter being henceforth too long for the more elastic covering, would tend to assume a serpentine form, and to push its way through the insulating material by slow degrees, particularly in places where short bends or kinks occurred.

Based upon these views, the author designed a sheathing of the following description:—The insulated conductor, or core, was passed in the sheathing works through a series of three machines in close succession. In passing through the hollow spindle of the first machine, a close spiral covering of hemp, previously saturated in Stockholm tar, was applied in such a way that each string was and remained under a given strain. The second machine was similar in construction to the first, but supplied a second covering of hemp wound in the opposite direction to the first. The rope thus formed, passed next through a stationary clip, with longitudinal grooves to prevent it from turning round in the operation immediately following, which consisted in the application under the influence of great pressure, of from three to six strips of copper, or other metal, which might best resist the action of sea water. These strips were accurately guided into the revolving covering tool, so as to overlap each other equally for nearly half their breadth, the pressure applied being sufficient to crush or socket the one metal down where it was covered by the other. This cable had no tendency to untwist; its extension with half the breaking strain upon it did not exceed one-half per cent., and being very strong, and of only double the weight of water, it would support about 8 miles of its own weight in the sea.

Considering that good ship's sheathing lasted about 10 years, when the ship was at rest, and that the cable had two layers of metal, with hardened tar between, it appeared not unreasonable to suppose, that the sheathing would last at the tranquil bottom of the ocean from 20 to 30 years at least. Several short lengths of this cable were now being tried, under various circumstances, and the results, so far, were promising of success upon a larger scale.

THE SEXTANT.

After the meeting, Mr. F. C. Webb (Assoc. Inst. C.E.) explained a modification of the ordinary sextant, by which larger angles could be measured than with the instruments now in use. Two sextants (by Messrs. Fletcher, of Leadenhall Street) were exhibited, one on the common arrangement and the other on the modified principle.

It was stated, that when the arm of the common sextant was at zero, the lines of incidence and of reflection, of an object seen in the horizon glass, formed a certain angle with one another, both at the object and horizon glass; and that this angle, termed the constant angle, deducted from 180°, gave the ex-

Digitized by Google

treme theoretical angle which could be measured. Practically this measurement was still further reduced, by the limits within which it was possible to reflect an object from a plane surface with accuracy, and which, if assumed as 170° instead of 180°, would give the angle from which the constant angle must be deducted to obtain the extreme angle capable of being measured. The smaller the constant, therefore, the nearer would this angle approach 170°, with a given amount of accuracy. It was observed that this constant angle was dependent on the relative position of the object glass, the eye piece, and the horizon glass, and was, in fact, the angle formed by a line drawn from the eye piece to the centre of the horizon glass, with a line drawn from the centre of the horzion glass to the centre of the object glass.

The reduction of this constant angle to a minimum was effected in the modification alluded to, by placing the eye piece very near to the object glass, and the horizon glass as far as possible both from the object glass and the eye piece. The extreme angle capable of being measured was thus considerably increased, and with conditions more favourable to accuracy; for whilst the angles of incidence and reflection in the object glass were not smaller than in an ordinary sextant, those in the horizon glass were constantly larger. With a given angle to be measured the conditions were more favourable to accuracy, since the lines of incidence and reflection formed larger angles with the reflecting surfaces, both in the object and the horizon glasses.

In marine and land surveying, and in taking altitudes of celestial objects with an artificial horizon (where the angle to be measured was double the altitude), this increase in the capabilities of the instrument was, it was believed, a manifest advantage.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, May 9.—The Duke of Northumberland, K.G., F.R.S., President, in the chair.

"On the Properties of Iron, and its Resistance to Projectiles at High Velocities."

By William Fairbairn, Esq., F.R.S.

We have no correct record as to the exact time when wrought-iron plates were first employed for the purpose of building vessels. It is, however, certain that iron barges were in use on canals at the close of the last century. In 1824 Mr. Manley, of Staffordshire, built an iron steam-boat for the navigation of the river Seine, and this was the first iron vessel that attempted a sea voyage. She was navigated from this country to Havre, by the late Admiral Sir Charles Napier, and although constructed for shallow rivers, she nevertheless crossed the channel in perfect safety. From that time to 1830 no attempt was made to build iron vessels, and nothing was done towards ascertaining the properties of iron as a material for shipbuilding.

A series of experiments instituted by the Forth and Clyde Canal Company in 1829-30, to ascertain the law of traction of light boats at high velocities on canals, led to the application of iron for the construction of vessels, and the lightness of these new vessels, combined with their increased strength, suggested the extended application of the material in the construction of vessels of much larger dimensions, and ultimately to those of the largest class both in the war and the mercantile navy. Considerable difficulty, however, existed with regard to the navy; and although the principle of iron construction as applied to merchant vessels and packets was fully established, it was nevertheless considered inapplicable, until of late years, for ships of war. It is true that until the new system of casing the sides of vessels, first introduced by the Emperor of the French in 1854, was established, the iron ship was even more dangerous under fire than one built entirely of wood. Now, however, that thick iron plates are found sufficiently strong, under ordinary circumstances, to resist the action of guns, not exceeding 120-pounders, for a considerable length of time, the state of the navy and the minds of our naval officers have entirely changed. We must, therefore, now look to new conditions, new materials, and an entirely new construction, if we are to retain our superiority as *mistress of the seas.* There yet remain amongst us those who contend for the wooden walls, but they are no longer applicable to the wants of the state; and I am clearly of opinion that we cannot afford to trifle with so important a branch of the public service as to fall behind any nation, however powerful and efficient they may be in naval construction. Having satisfied ourselves that this desideratum must be attained, at whatever cost, I shall now endeavour to point out such facts as in my opinion relate to the changes that are now before us, and simply endeavour to show—

1st. The description of iron best calculated to secure strength and durability in the construction of ships of war.

2nd. The distribution and best forms of construction to attain this object; and,

Lastly. The properties of iron best calculated to resist the penetration of shot at high velocities.

Properties of Iron.—If we are desirous to attain perfection in mechanical, architectural, or shipbuilding construction, it is essential that the engineer or architect should make himself thoroughly acquainted with the properties of the materials which he employs. It is unimportant whether the construction be a house, a ship, or a bridge. We must possess correct ideas of the strength, proportion, and combination of the parts, before we can arrive at satisfactory results; and to effect these objects the naval architect should be conversant with the following facts relating to the resisting powers of malleable and rolled iron to a tensile strain.

The resistance in tons per square inch of—

Yorkshire Iron is	. . .	24·50 tons.
Derbyshire	„ . . .	20·25 „
Shropshire	„ . . .	22.50 „
Staffordshire	„ . . .	20·00 „

Strength of Rivetted Joints.—The architect having fortified himself with the above facts, will be better able to carry out a judicious distribution of the frames, ribs, and plates of an iron ship, so as to meet the various strains to which it may be subjected, and ultimately to arrive at a distribution where the whole in combination presents uniformity of resistance to repeated strains, and the various changes it has to encounter in actual service.

There is, however, another circumstance of deep importance to the naval architect, which should on no account be lost sight of, and that is, the comparative values of the rivetted joints of plates to the plates themselves. These, according to experiment, give the following results:—

Taking the cohesive strength of the plate at .	100
The strength of the double-rivetted joint was found to be	70
And the single-rivetted joint	56

These proportions apply with great force to vessels requiring close rivetting, such as ships and boilers that must be water-tight, and in calculation it is necessary to make allowances in that ratio.

Strength of Ships.—Of late years it has been found convenient to increase the length of steamers and sailing vessels to as much as eight or nine times their breadth of beam, and this for two reasons; first, to obtain an increase of speed by giving fine sharp lines to the bow and stern; and second, to secure an increase of capacity for the same midship section, by which the carrying powers of the ship are greatly augmented. Now, there is no serious objection to this increase of length, which may or may not have reached the maximum. But, unfortunately, it has hitherto been accomplished at a great sacrifice to the strength of the ship. Vessels floating on water and subjected to the swell of a rolling sea,—to say nothing of their being stranded or beaten upon the rocks or sand banks of a lee shore,—are governed by the same laws of transverse strain as simple hollow beams, like the tubes of the Conway and Britannia tubular bridges. Assuming this to be true, and indeed it scarcely requires demonstration, it follows that we cannot lengthen a ship with impunity without adding to her depth or to the sectional area of the plates in the middle along the line of the upper deck.

If we take a vessel of the ordinary construction, or what some years ago was considered the best—300 feet long, 41 feet 6 inches beam, and 26 feet 6 inches deep—we shall be able to show how inadequately she is designed to resist the strains to which she would be subjected. To arrive at these facts we shall approximate nearly to the truth by treating it as a simple beam; and this is actually the case, to some extent, when a vessel is supported at each end by two waves, or when rising on the crest of another, supported at the centre with the stem and stern partially suspended. Now in these positions the ship undergoes, alternately, a strain of compression and of tension along the whole section of the deck, corresponding with equal strains of tension and compression along the section of the keel, the strains being reversed according as the vessel is supported at the ends or the centre. These are, in fact, the alternate strains to which every long vessel is exposed, particularly in seas where the distance between the crests of the waves does not exceed the length of the ship.

It is true that a vessel may continue for a number of voyages to resist the continuous strains to which she is subjected whilst resting on water. But supposing in stress of weather, or from some other cause, she is driven on rocks, with her bow and stern suspended, the probability is that she would break in two, separating from the insufficiency of the deck on the one hand, and the weakness of the hull on the other. This is the great source of weakness in wrought-iron vessels of this construction, as well as of wooden ones, when placed in similar trying circumstances.[*]

(To be continued in our next.)

MEETINGS FOR THE WEEK.

Mon.—*Royal Geographical Soc.*, I. "Excursion from Damascus to Harran, and thence through the Holy Land," by Charles Beke, Ph. Dr. II. "Late Surveys in the Pacific, by H.M.S. Herald, under the command of Captain N. M. Denham, R.N." III. "Short Narrative of a Journey, Overland, from Nagasaki to Yeddo, in Japan," by Rutherford Alcock, Esq., of Japan, at 8.30 p.m.

British Architects, at 8 p.m.

Wed.—*Royal Soc.*, at 8 p.m.

Thur.—*Linnean*, at 8 p.m.

Antiquaries, at 8.30 p.m.

Society for the Encouragement of the Fine Arts, Election of Officers for the Ensuing Year, and Announcement of Prizes, at 8 p.m.

TO CORRESPONDENTS.

Received.—B. C., J. N., A. R. M., J. H., Amateur, J. B., W. R. M., J. H. J., J. N., G. C., W. B., Capt. H., M.A.M.

Philo's letter is too diffuse and personal for us. We cannot insert long and wearisome letters.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

IRON ARMOUR TO RESIST HEAVY ORDNANCE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Allow me to say a few words upon iron-armour to resist heavy ordnance at short ranges. Solid iron plates made with infinite skill and of the best materials have been so sadly mauled, that some persons are beginning to believe in an essential superiority of attack over defence, and it is quite supposable that this may turn out to be the true state of the case. The resources of art, however, are no more exhausted at present for defence than for attack. One simple idea suggests itself, and I think is worthy of trial, because it embodies a known property of matter, and offers a ready way to dispense with bolts, tongues, *et id genus omne* almost entirely. Let the principle of a bale of cotton be accepted as the primary illustration; next conceive of the same as made up in a more orderly manner of a pile of sheets of calico closely pressed together; all the fibres lying woven in transverse directions; then extend the bale to any size in length and breadth, preserving the thickness; transfer all this to iron; and to complete the suggestion, let the weaving be so conducted that the warp and woof of the different overlaying strata are interwoven, and combine the whole into one thick woven mass of iron wire. This can be manufactured of any fineness, thickness, or shape and size, and might be made to order and measure, like a suit of clothes, for a ship of war; it would require comparatively little fixing, show no seams or grooves or through-bolts, scatter few splinters when damaged, and allow no cracks to run out radially from the point of precussion like the flaws of a starred window. I should like to ask a question of the practical engineers: if you had to punch a hole by percussion in a plate of cast-iron, another of wrought iron, and a mass of woven iron such as I have described, should you not expect to shatter the cast iron, to go clean through the wrought iron, and to be brought up by the iron wire?

I am, sir, your constant subscriber,

John Eyre Ashby, L. L. D.

Enfield, June 6th.

MR. SCOTT RUSSELL'S TARGET.

Sir,—On reading your report of the trial of Mr. Scott Russell's iron target at Shoeburyness, I was struck with the fact that two people equally unbiassed may draw very different conclusions from the same experiments. I was present at the trial, and as my observations seem to differ somewhat from your correspondent's I send them to you. They may, perhaps, help to establish the truth.

Your correspondent, "A Civilian," predicted beforehand what he imagined would be the result, therefore, I am not surprised to find him trying to prove in his letter of this week, that his own penetration is even greater than Sir William Armstrong's 300-pounder.

---

[*] See Vol. I. of the "Transactions of the Institution of Naval Architects," on the Strength of Iron Ships.

Two things, I think, were proved by the trial: first, that it is quite possible to get the fastening to stand on a target made entirely of iron, and to hold the plates on until they are entirely destroyed. No other fastening besides the continuous rivetting has done this. In all the other targets the bolts have invariably been broken off, the plates have started at the ends and become insecure. At the end of the day's firing, the plates on Mr. Russell's target were as flat and secure as at the beginning, and the flush rivetting was almost uninjured. This, I think, is an important point, for I am afraid there is an opinion gaining ground, that it is impossible to make the fastening of a rigid target stand the constant jarring. All practical men are aware of the great advantages to be gained by using iron only, therefore the problem must not be given up until it is completely solved. Whether "Civilian" or any one else can propose anything better than the continuous rivetting, remains to be seen; nothing better has been proposed yet.

The other point proved by this trial and also by the trials of all the other iron targets is the absolute necessity of an inner skin to stop the fragments caused by the shot. Every fragment from the third 150 pound shot fired at Mr. Russell's target, was stopped by a plate rivetted on to the back of the ribs, between the ports where this shot struck; but this point I see Mr. Russell has already explained, therefore I need not enlarge upon it.

A MECHANIC.

June 10th, 1862

◆

A NEW TEST FOR TARGETS.

SIR,—Upon the all-absorbent question of iron defence, may I be permitted to take up a small portion of your space. When the number of suggestions thereto multiply daily so rapidly as appears by your publication, and it is more than ever incumbent that none should be rejected capriciously which bear any evidence of a tendency to the resolution of the matter proposed, it becomes a necessity that those acknowledged to be so far deserving of proof, should be tested at the least possible expense of money and time, and to do so I venture the following proposition with all deference to the glory and *eclat* of powder with all its accessories. I simply propose that in future the test for all targets may be more economically conducted by a far more simple process, with equal certainty here in London, by bringing to bear upon the target to be tested. The simple direct and vertical force of a falling weight which either may be a sphere of equal density throughout, or if requisite to ensure a proper fall of unequal density, of any fixed or of progressing weights. Or it might be of cylindrical form with any sort of point, steeled or not. It may be heavy pointed and hollow tailed, or it may be winged or vaned on the tail to rotate in its downward flight; all these points with every variety of weight will be at command. I would confine the section to be tested to ten feet square, laid horizontally upon a curb constructed upon a well piled foundation, filled in in the most solid manner. The section might be laid upon either solid or hollow bearings, or upon a bed either wholly or partially elastic; a large number and variety of suggestions to this part of the question will be easily determined. The ball or cylinder I would let fall from a timber vertical framed stage of, say a 100 feet high. This is an arbitrary number to be settled by calculation or experiment, as well as the amount of weight falling to produce the equal effect to one from powder and ball—as a data.

I have no fear that a series of invaluable results would be at our service at a comparative small expense, teaching not only the proper amount of material to be used, but the best mode of manufacture as well in the fastenings and bedding.

Yours obediently,

GEORGE B. COOPER.

West Central Iron Works, 121 Drury Lane,
June 3rd, 1862.

◆

PUNCHING IRON PLATES.

SIR,—In "A Civilian's" letter in your valuable journal of the 6th inst., I notice a statement that "no force will drive a punch through a plate unless it be of *greater* diameter than the *thickness* of the plate. A one-inch steel punch will not go through a one-inch iron plate." I can show your correspondent several "burrs," 1¼ in. diameter, which were punched out of plates 1½ in. thick; we also punched 1¼ in. holes in 1½ in. plates, but the press was much strained, as it was not strong enough for such heavy work.

Yours obedient, C. F. T. Y.

London, June 7th, 1862.

PHOTOGRAPHY ON WOOD FOR ENGRAVING.

SIR,—To photograph on wood has long been held a desideratum, and at various times it has been announced to the world as accomplished. But from the peculiar properties of the material to be operated on, and certain indispensable requirements on the part of the engraver, it does not appear to have been so successfully achieved as to obtain a general application.

Although photography is regarded by some as giving but a defective representation of nature (in comparison with the image depicted on the human eye), arising from the imperfections connected with the construction of the camera, as well as from the unequal action of light upon various colours, nevertheless, when taken as a whole, we obtain by its agency a larger amount of truth than cannot possibly be rendered by the most skilful artist's hand.

Having, as I believe, surmounted the various obstacles which hitherto seem to have prevented its use, I may be permitted to point in some directions where its application appears well suited.

Wherever extreme minuteness or intricate and delicate forms have to be delineated, as in microscopic representations, botanical, anatomical, insect, reptile, or such like departments pertaining to science, it supplies a want not adequately met by hitherto existing means.

But not merely is it to be limited to what may be deemed the useful; but be extended also to the ornamental, reaching even to pictorial and subject art.

In portraiture (a branch so well understood by the public) it offers considerable aid providing, as it does, an amount of individuality unequalled by the most consummate skill; and if additional qualities are desired, such as no chemical or mechanical operation is ever likely to effect, then it provides a basis for artistic taste and treatment, by which truth and ideal beauty may be combined.

And, again, in elaborative architectural gothic design, or in mechanical work of every kind, it alike lends a helping hand.

In order to fully accomplish all that may be expected from it, some degree of adaptation may be essential on the part of the engraver. But he, having shown himself able to realise the various styles of present artists, will be capable of following so far as is practically possible the style of the new master. And when thoroughly understood, photography may be instrumental in elevating wood-engraving to a degree of excellence beyond anything yet attained.

And now that pictorial illustration has become almost identical with printing as the instructor of the world, any assistance extended thereto cannot but be accepted as an acquisition. ROBERT MARTIN.

◆

ANTI-CORROSIVE CEMENT FOR IRON SHIPS.

SIR,—I invite all parties interested in preventing the corrosion of iron, to give the following composition a trial. It will be found an excellent substitute for copper sheathing.

Melted pitch	6 pounds
Linseed oil	½ a pound
Brick dust	5 ounces
Finely pulverized iron filings .	5 ounces
Ashes	6 ounces—[mix.

Apply one-coat, and when dry apply a second.

NOTE.—If any rough timber is coated with this composition (taking care previously to wash it over with *glue*), it will resist the effects of fire for upwards of five hours!

I am, sir, your obedient servant,

JAMES BRUCE.

June 5th, 1862.

◆

THE MIDDLE LEVEL INUNDATION

SIR,—As I pointed out in the MECHANICS' MAGAZINE, three weeks ago, the coffer dam has burst from the cause I strongly impressed upon the engineers, viz., that if they placed reliance upon throwing thousands of bags of earth into the drain on the upper side of the dam, they would be washed away, from the treacherous nature of the soil into which the piles were driven.

I now beg again most respectfully, but at the same time most urgently to state, that my plan for the stoppage of the tidal waters be duly considered, which consists in spreading on the upper side of the dam, a sheet of strong naval canvas, which can be made to any size; the outer end to be secured to the bottom by iron weights, and the end next the dam to be raised above the water and secured to the piles. To give the dam greater stability, I would secure the ends of hawsers or chains to the top and bottom of the piles; the other ends of the hawsers or chains to be taken ashore and secured to anchors or other suitable holdfasts, and the chains or hawsers to be tightened by block and tackle.

This plan need not cause any delay or much expense, nor interfere with the work already begun, but greatly facilitate it; as scouring is effectually prevented, the dam is rendered watertight and held securely in position.

As materials for the above plan, together with a staff of riggers, can be had at once, I could render the dam most efficient in a very short time.

Your obedient servant,

JOHN MACINTOSH.

June 10th, 1862.

Gossip.

Mr. C. W. Forbes has written us a long letter in which he proves that he suggested to the government, in 1856, the practicability of working guns on the turntable principle. The war office would not listen to him, as "Lord Panmure was satisfied that the principle was inapplicable to the military service." that was then inapplicable, is now being adopted. Mr. Forbes, therefore, disputes the priority of Captain Cole's claim to the invention.

Mr. Goibal, professor at the school of mines at Mons, has recently applied very successfully the compression of water to the detaching of rocks from their beds, and especially to the extraction of coal. At a recent meeting of the Society, formed by the old pupils of that school, he produced a cast-iron cylinder, divided in two by a partition, parallel to its axis, and presenting the appearance of the shaft of a mine. By the application of the pressure of water, he then broke the two cast-iron hoops which bound the two parts of the cylinder together, and the transverse sections of which presented a surface of 100 square millimetres. By calculation it was found that the pressure applied was equal to 75 atmospheres—a pressure quite sufficient to detach coal, but far within the limit which might, if necessary, be obtained.

In the course of a lecture on "Mechanics," given before the members of the Horological Institution a short time since, Mr. Hislop related the following amusing story, illustrative of the law of *Inertia*:—"A newly raised body of volunteer cavalry were mounted and put through the ordinary revolutions of a field-day. The inspecting officer remarked, however, that when halted suddenly at the charge, the line was not well kept, many of the horses shooting beyond it. The excuse was that the horses were not so well trained as those of regular troops. The inspector, apparently yielding to the justice of the observation, remarked that a troop of cavalry would shortly be quartered in the neighbourhood, and that he would then take an opportunity of doing justice to the volunteers, by mounting them on the cavalry horses. The time came, and the experiment was made. The men sat their horses admirably, and the whole swept across the plain like a whirlwind; suddenly the halt was sounded, the well-trained steeds obedient to the sound, and not heeding the hands of the riders, stopped at once, but three-parts of the riders did not stop, but, propelled forward by their acquired momentum, passed over the horses' heads, and were deposited like so many bags of sand on the green sward.

At a recent meeting of the Franklin Institute, Philadelphia, Mr. T. Fisher exhibited a feed-bag for horses. It consists of a feed-bag of the ordinary form, to the bottom of which can be attached at pleasure a jointed rod, which may be folded up with the bag so as to readily pack to the saddle when not in use. A strap passes over the head of the horse so as to hold the bag in position, the end of the jointed rod resting upon the ground and supporting the bag, so that the animal can obtain all the feed that is in it without tossing it up, as is necessary with the form of feed-bag usually employed. This is particularly useful for cavalry, or those who carry their horse-feed with them, in travelling. Mr. Edward Longstreth exhibited and explained a patent oil-can for oiling valves and pistons while under pressure, without cutting off the steam; also, some specimens of malleable horse-shoe nails, made by machinery invented by Mr. William C. Grimes, of Philadelphia. Mr. Charles S. Close exhibited a stove for army purposes, having the plates united by scroll joints, which may be folded up when not in use, so as to occupy but a small space.

The replies of the Inspector of Mines to the circular letter of the Home Secretary have been published, and there is a general agreement of opinion therein as to the necessity of further legislation for the pre-

Digitized by Google

vention of accidents through the falling in or closing of shafts. The following are the recommendations of Mr. Higson, and they may be taken as representing the views of nearly the whole of the inspectors:—1. That the 6th general rule be so amended as to compel every future working and pumping pit or shaft to be securely cased of lined throughout with iron, brick, or stone. 2. That on and after the first day of January, 1863, proper guides or conductors shall be provided, and used in every pit or shaft in which persons ascend or descend; and that at every working pit or shaft there shall be moveable or self-adjusting guards or gates to fence off the entrance thereto. 3. That from the workings of every mine there shall be two distinct shafts or outlets, not less than ten yards apart. 4. That mines now opened and being worked with a single bratticed shaft may be continued for three years, if during that period active operations are in progress to effect a second outlet, and the means of egress therefrom. 5. That for the purpose of exploring or proving the ground, a single bratticed shaft may be used for a period of six months after finding the vein or seam, provided that not more than ten persons shall be in the pit at the same time. 6. That when water has to be pumped in a single bratticed shaft proper and satisfactory preparations shall be previously made to prevent detached portions of the machinery or other apparatus, in case of breakage, falling into the pit or shaft. 7. That during the time persons employed in working any mine are ascending or descending the pit or shaft, pumping in that pit or shaft shall be suspended.

The Emperor of the French has nominated a commission, consisting of the Ministers of Marine and Finance and the Engineer-in-Chief, to organise a complete system of lifeboats on the French coast similar to that now so efficiently in operation on the English coast, chiefly under the control of the National Lifeboat Institution. France has a seaboard of nearly 900 miles. Hitherto the means of saving life from shipwreck on it has been lamentably deficient. Some engineer officers are now on the French Coast gathering every information they can on this important subject. It is expected that they will shortly cross the channel and visit some of the English lifeboat stations.

In the fine art section of the International Exhibition there is to be found a great deal of fine work, known generally by the French term, *repoussé*. Plate for presentation, and race-cups, are the best known specimens of this class of work, and foreigners are largely employed in this country in its production. The hammer and wooden mallet play important parts in getting up *repoussé* articles. If the design for a race-cup, for instance, is to be got up in silver, a sheet of that material is first cut into the form of the object, when developed on a plain surface. It is then beaten into a hollow dish by means of a mallet. When a proper degree of concavity has thus been given, the bases for the ornamental projections are formed by the hammer, the silver plate being moved as required over bars of iron, or more properly speaking, small anvils. Skilful manipulation is here required. In order to produce more exactly these projections, or, if need be, to form indentations, the silver vessel is filled now with a composition of pitch and other ingredients. This allows of the administration of blows with punches on the exterior at particular points without destroying other parts of the work. When the relief is fully modelled up, the finishing touches are given by the use of the graver. The pitch is next melted out and the inside is cleaned, and it may be gilt and burnished. This in a general way is the mode of producing *repoussé* work, but of course there are intricacies and niceties about the art which require skill, practice, and taste, for their development.

In one of the Yorkshire collieries, an advance, of a character most important to the miner as to the coalowner, has been made in the working of coal. This is nothing less than to do the work of the "hewer" by the aid of a coal-cutting machine, worked by a compressed air engine. Another advantage of this important invention is said to be that it will ventilate the mine, as well as cut the coal. It has been tried at the Balaklava Pit, on Tingley Moor.

Medal of the Prince Consort.—A medal by Mr. Charles Wiener, medallist and sculptor to His Majesty the King of the Netherlands, has just been struck in memory of his Royal Highness the Prince Consort as the founder of the International Exhibitions of 1851 and 1862. It is about three inches in diameter and one eighth of an inch in thickness. The obverse represents the Prince as he appeared three months before his death, when it has been said, he looked as well as at any other period of his life. No photograph or engraving we have seen presents a more striking likeness. The lines are as sharp and clear as those of a steel engraving, and the contour of every feature in the fine countenance of the late Prince are brought out with wonderful delicacy and faithfulness. The hair, whiskers, and moustache, which always present a difficulty to sculptors in bas relief, are particularly well managed. The reverse of the medal bears the words "Founder of the International Exhibitions of 1851 and 1862," surrounded by a wreath of oak leaves and acorns, which has very high merit as a work of art.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2904, 2905, 2928, 2931, 2940, 2948, 2951.
Boilers and their Furnaces, &c., 2933.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2920, 2937.
Ships and Boats, including their fittings, *None.*
Cultivation of the Soil, including agricultural and horticultural implements and machines, *None.*
Food and Beverages, including apparatus for preparing food for men and animals, 2901.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2899, 2927, 2932, 2913, 2950, 2954, 2955.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c. 2911, 2916, 2952.
Lighting, Heating, and Ventilating, 2913, 2922.
Furniture and Apparel, including household utensils time-keepers, jewellery, musical instruments, &c., 2907, 2915, 2919, 2923, 2934, 2938, 2947.
Metals, including apparatus for their manufacture, 2900, 2920, 2925, 2944.
Chemistry and Photography, 2906, 2917, 2924.
Electrical Apparatus, *None.*
Warfare, 2908, 2918.
Letter-Press Printing, &c., *None.*
Miscellaneous. 2902, 2903, 2909, 2910, 2912, 2914, 2921, 2926, 2930, 2935, 2936, 2939, 2941, 2942, 2945, 2946, 2949, 2953.

2906. S. Dede. *A new process of discolouring, purifying, and improving varnish, oil, resin, gum, ether, wines, spirits, and other matters, through the application of compressed air.* Dated Nov. 19, 1861.

Here the inventor proposes to discolour, or take away colour from, and to purify or improve oils, gums, resins, ethers, wines, brandy, vinegar, alcohols, essences, and other matters by the application of compressed air, such application being modified according to the nature of the matter or liquid under treatment, and the result desired. *Patent abandoned.*

2907. R. D. Godfrey. *An improved boot or shoe with a wooden shank part and a flexible fore part to the sole.* Dated Nov. 19, 1861.

This consists in working the shank or rear part of the sole, which does not require to bend, of wood, and the front of the sole of a more flexible material, as vulcanised india-rubber or leather. *Patent completed.*

2908. R. A. Brooman. *Improvements in breech-loading fire-arms.* (A communication.) Dated Nov. 19, 1861.

This invention consists, 1, in a manner of opening and closing the breech; and, 2, in the introduction of a peculiar self-adjusting clearing and gas-stopping plate within the rear opening of the barrel. The improvement in the mode of opening and closing the breech consists in a combined revolving plug and shear plate, whereby the opening and closing of the breech and the shearing off of the end of the cartridge is accomplished by a semi-revolution performed twice, or of a whole revolution once performed of the said plug. The breech-plug is a cylinder of larger diameter than the bore of the gun; it is fitted in a socket formed in the stock, and immediately in the rear of the barrel, and is not described in detail apart from the drawings. *Patent completed.*

2909. J. Schloss. *Improvements in pouches.* Dated Nov. 19, 1861.

This invention consists in cementing or otherwise securing inside of ordinary flap pouches, one or more division pieces with or without a flap or flaps. Supposing only one division piece with a flap is used, then the patentee cements the bottom and side edges to the inside of the pouch, and leave the flap free. The tobacco or other material to be contained in the pouch is inserted between the back of the pouch, and the division piece, the flap of the division piece is turned over the tobacco towards the back of the pouch, and the flap of the pouch is brought over the flap of the division piece, and tucked in between the division piece and the front of the pouch. *Patent completed.*

2910. F. L. Stott and M. Tomlinson. *Improvements in the construction of vessels or apparatus for supplying lubricating matter to mechanism.* Dated Nov. 19, 1861.

This consists in combining a glass vessel or cistern for containing the oil, or other lubricating matter, with a tube of metal, or partly of metal and partly of glass, this tube ascending from the bottom of the interior of the vessel or cistern to nearly the top of it, and being also continued below the bottom for a short length so as to conduct the oil, &c., delivered by the wick (which descends the tube) to the orifice or communication leading to the journal or other mechanism to be lubricated. *Patent abandoned.*

2911. G. Gwilliam. *Improvements in the manufacture or production of plate glass.* Dated Nov. 20, 1861.

Here the inventor proposes to rub, smooth, or flatten the upper surface of the newly-cast plate by passing to and fro over the same a suitable rubber composed of a bar of wood, metal, or other suitable material, a long handle being fitted to such rubber for the purpose of facilitating the working or the operating of the same by the attendant workmen. *Patent abandoned.*

2912. J. H. Johnson. *Improvements in machinery or apparatus for cutting irregular and curvilinear forms in wood or other similar substances.* (A communication.) Dated Nov. 20, 1861.

This consists, 1, in combining with a table, or other equivalent means for rotating the frames to be cut, a pattern of the general form of frame to be produced, and two rotating shafts, each carrying a suitable tracer and cutters. One of these shafts is made self-adapting to the other by a lateral sliding motion, whilst the other shaft is by a similar contrivance made self-adapting to the inner periphery of the pattern, so that the cutters, which, by their form and rotation, produce the required mouldings, shall be guided in the required track to cut the general form of the frame to be produced. 2. In the combination with a pattern and tracer of two sets of cutters carried by parallel shafts, and so mounted that the distance between two shafts shall be self-adapting by a lateral sliding motion of the shaft, the cutters being forced up to the work by a weight or equivalent yielding pressure, whether one or both of the said shafts be so mounted. 3. In so arranging two parallel cutter shafts that the entire surface of a frame can be cut at one operation without any liability of the cutters interfering with each other. *Patent completed.*

2913. E. F. Smith and T. Swinnerton. *An improvement or improvements in the manufacture of coke.* Dated Nov. 20, 1861.

Here the inventors make coke heaps of the ordinary kind, the said coke heaps being covered as usual with coke dust, &c. On the summit of the coke heap they fix a pipe or tube of iron, the lower end of the tube opening just above the top of the coke heap, and being luted by a clay or sand lute to the said top of the coke heap. The said tube is connected with a stack or tall chimney, or with the furnace of a steam boiler, or other furnace, and a strong draught is thereby determined through the said pipe and coke heap, the air passage from all sides on the exterior of the coke heap into the interior, and up the pipe or tube into the stack of chimney. By this method the sulphur contained in the coal is wholly or partially removed. *Patent abandoned.*

2914. F. Johnson. *Improvements in ground or earth screws.* Dated Nov. 20, 1861.

This consists in making the periphery of the flange of the screw with a number of teeth, similar to a circular saw, and arranged so as to assist the pitch of the screw, thereby enabling it to cut its way into the ground with greater facility than those at present used with a plain unbroken flange; or the screw may be made by having only a portion of its periphery with teeth; and in this case a projection can be made at its cutting edge, so that the remainder of the screw, which is of a lesser diameter, would follow in the opening made by the said projection. *Patent completed.*

2915. J. C. Croxford. *An improved mode of fastening doors, and for other similar purposes.* Dated Nov. 20, 1861.

This consists in constructing a fastening for doors, drawers, windows, and other like purposes, in the following manner:—A segmental or straight bolt is worked by, or, if preferred, fixed to the handle, on turning which the bolt is made to protrude, and enter a groove or other similar provision made in the door jamb; one or more catches or tumblers fall by this movement, and prevent the return of the bolt; therefore, to unlock, it is necessary not only to lift the tumblers or catches, but at the same time to turn the handle. The patentee also makes a key-way in the lock which turns with the key, so that on any attempt being made to introduce a pick the key-way closes itself, and leaves but a very small passage to introduce anything further. *Patent completed.*

2916. W. P. Bayliss. *Improvements applicable to buildings, in order to facilitate the extinguishing of any conflagration which may happen therein.* Dated Nov. 20, 1861.

This consists in constructing buildings with an aperture, or with apertures, at the upper part of each apartment, the said apertures being in communication with tubes or channels opening into the chimney, or into the external atmosphere. Hence, if a fire takes place in the building, it will only be necessary to close the apartment and the smoke and fire will vent by the said apertures. The invention also consists in placing a cistern or receptacle at the upper part of the building, from which pipes descend which reach from the said cistern to the basement of the building, and may form supporting columns or pillars to it. Suitable branch pipes and valves are employed for conveying the water into any apartment where fire may occur. *Patent completed.*

2917. F. Pals. *Improvements in treating fatty and oily matters.* Dated Nov. 20, 1861.

This consists in subjecting fatty or oily matters to the action of an oxidizing agent, which agent consists of oxygen gas rendered more active by the means described in the specification of a patent, No. 1207, dated 13th May, 1861. *Patent abandoned.*

2918. L. Thomas. *Improvements in the mode of manufacturing and constructing wrought-iron ordnance.* Dated Nov. 20, 1861.

This consists in making guns of coils of sheet iron wound upon a staff or core bar, or upon each other, so as to avoid, as much as practicable, the necessity for having welded joints or surfaces at right angles or nearly so to the axis of the bore of the guns. *Patent completed.*

2919. E. Peyton and W. F. Batho. *Improvements in the moulds or chills employed in casting corner blocks, dovetail grooves, and other parts of metal bedsteads and other like articles, in frames for carrying such moulds, and in tubes for the pillars of bedsteads and other like articles.* Dated Nov. 20, 1861.

This invention consists in constructing the moulds or chills in manner hereafter explained. The moulds are composed by preference of two principal parts or boxes, each of which will lift away from the other after the casting is completed. The patentees describe first one part or box, and then the other, supposing only two parts to be used. The first part consists of two cheeks of iron, between which is inserted what they term a bed equal to the length or thickness of the intended dovetail grooves; the cheeks and bed are bolted together. Upon the bed a chill or metal mould containing the counterparts of the two dovetail grooves, and of the inner side of the pillar block, is inserted, and this chill is also equal in length or thickness to that of the intended block and dovetail grooves; an aperture is made in the cheeks of the box for the pillar on which the casting is to be effected to pass through. The second main part or box consists also of two cheeks, between which a metal chill or mould is fixed, which chill, when the two boxes are placed together, completes the pattern or shape of the corner block to be cast. Apertures are formed in the cheeks of the second part, which correspond with those in the cheeks of the first, for the reception of the pillar on which the casting is to be effected. When any raised pattern or device is to be cast on the outer part of the blocks, which will not allow of the casting leaving the moulds, then the chills must be formed in pieces, and loose pieces may be added which will come away with the casting and drop off or be readily removed. The gate for pouring in the metal is formed in the thickness of one of the cheeks in each of the boxes or main parts. Although they have described the two boxes as formed of three pieces, yet they may be formed in one piece. The moulds or chills for casting on other parts of the pillars are formed similarly to those described, only the internal "chill" or mould must be varied according to the form required to be produced Again, instead of the internal mould or chill for the dovetails and inner side of the pillar block being only equal in length or depth to that of the intended dovetails and blocks, the chill may be made to pass through the cheeks of the box, and may be composed of one, two, or more pieces. In casting large corner blocks, in order to obtain lightness and ornament, they sometimes use sand or loam cores in connection with the chill, and run the sand out or not after the casting is completed through the centre of the pillar or otherwise. They construct the frame for carrying the chills of a cast iron planed bed, on to which the chills are bolted, supported horizontally by two standards held together by stretchers; there are journals at the ends of the planed bed working into suitable bearings in the standards, so that the bed is free to revolve and carry the chills into the most convenient position for pouring. The bed may be made double to carry two sets of chills. The above frame, with the addition of suitable slides to carry the necessary chills in the case of French ends, is applicable for casting stump and French ends complete. In casting dovetails on to the sides and ends of bedsteads, they use chills or boxes open at top and bottom, which are placed on the frame before described, and by means of it can be turned into such a position as will bring the gate on the under side, and thereby do away with grinding. The invention further consists in forming the pillars for bedsteads and other like articles at those parts where the corner blocks and dovetails or other projections are to be applied of increased diameter to that of the other parts of the pillar. *Patent completed.*

2920. J. H. Johnson. *Improvements in the treatment of zinc ores, and in the apparatus employed therein, which improvements are also applicable to the manufacture of phosphorous.* (A communication.) Dated Nov. 20, 1861.

Here, for the production of metallic zinc, or oxide of zinc, the ores, in combination with the proper fluxes, are subjected to an elevated temperature in a suitable oven or reverberatory furnace, before introducing such ores and fluxes into the blast furnace. *Patent completed.*

2921. T. Cowburn. *Improvements in apparatus for elevating boiling soap, and for dividing the same into bars when congealed.* Dated Nov. 21, 1861.

This consists in elevating boiling soap from the vessel in which it has been boiled to the required level by an endless chain of buckets passing over two pulleys, one of which is placed in the vessel containing the boiling soap, and the other being supported at the proper level in a frame by two or more pipes which are received together in the usual way of gas pipes. *Patent abandoned.*

2922. J. Parkinson and C. H. Minchin. *Improvements in the "Davy" or other safety lamps for mining.* Dated Nov. 21, 1861.

Here the inventors place in the interior of the wire gauze chimney an extinguisher, working in guides or otherwise, and supported by solder that fuses, or other material that yields or gives way at a certain temperature. To prevent the lamp from being opened with too great facility, they place a screw or fastener through or above the part which connects the chimney with the bottom of the lamp, which screw or fastener firmly locks the lamp, and must be removed before the lamp can be opened. A second extinguisher is placed in the chimney, and is held by a catch when the lamp is shut; but on opening the lamp the catch is released, and the light extinguished by the falling of the extinguisher. *Patent abandoned.*

2923. J. H. Jays. *Improvements in the manufacture of collars, shirt-fronts, cuffs, hats, bonnets, vests, and other articles of wearing apparel.* Dated Nov. 21, 1861.

Here the patentees fasten together two sheets of common calico, &c., of any desired colour, by starch gum, and an article known as "paper size," after which they are passed between cold rollers either engraved or plain, which will give them the desired pattern, and glaze as of starched and ironed material. *Patent completed.*

2924. G. A. Polybank. *Protecting and preserving photographic and other prints, water-colour drawings and other works of art from injury and decay.* Dated Nov. 21, 1861.

This consists in coating the work of art to be protected and preserved, with paraffin made fluid by heat. *Patent abandoned.*

2925. J. Gittoes, Jun., and G. Hinton. *Certain improvements in cupolas and furnaces for smelting or reducing ores, and for the re-melting of pig iron.* Dated Nov. 21, 1861.

This consists in constructing cupolas with an outer casing or jacket extending up from the bottom about 12 feet, more or less, as may be found most efficient, leaving an opening around the cupola between the jacket for case and the brickwork of the cupola of about six inches, but which opening or chamber the inventors divide into two parts, so that one shall have no connection with the other, and to each of these recesses they convey the blast from two distinct blast ways, admitting the blast at or near the top of each recess, and into each blast they propose applying suitable valves, so that they may be able to stop or control the blast in either of them at pleasure. At the bottom of this air-way separate vertical air-ways are formed for conducting the air down to the tuyers, which tuyers are arranged, appropriating about four, more or less, to each recess or air chamber before mentioned. *Patent abandoned.*

2926. J. Stubbs. *Improvements in apparatus for heating and evaporating brine in the manufacture of salt.* Dated Nov. 21, 1861.

This consists in arrangements of apparatus whereby the brine to be evaporated is supplied to the pan at an elevated temperature, and consists in the use of a large shallow wrought iron evaporating pan, as ordinarily used, heated by a fire-place or by fire-places at one end of the pan, and within these fire-places is a number of iron tubes in connection with the evaporating pan, in lieu of being supplied at the ordinary temperature. *Patent abandoned.*

2927. E. Brooks. *Improvements in machinery for combing wool and other fibrous substances.* Dated Nov. 21, 1861.

This consists in the adaptation of machinery for the combing of wool, &c., of screw gill apparatus, which is worked in successive sets of fallers. These sets of fallers are carried forward in one and the same set of screws by the rotation of the same, and are made to drop from or pass out of the fibre by the usual tappet apparatus. *Patent abandoned.*

2928. W. E. Newton. *Improvements in rotary engines.* (A communication.) Dated Nov. 21, 1861.

This relates more particularly to that class of rotary engines whose main shaft, and the rotating cylindrical drum to which the pistons are attached, are arranged excentrically to the outer cylinder. The invention consists, 1, for controlling and directing the compound radial and oscillating movement of the pistons of engines of the above mentioned class, of segment shaped pieces of metal, fixed to the faces of the pistons and to bearings provided for them in the drum, and also of arc-formed pieces attached to the inner ends of the pistons, and working in grooves in the cylinder heads. 2. In the employment of packing rings of peculiar construction, and applying the same within the cylinder heads, and in combination with the piston drum, piston packing, and cylinder abutment, whereby the steam is prevented from pressing the piston drum and pistons. 3. In a novel construction of, and means of pressing out to the proper contact with their opposed wearing surfaces, the aforesaid packing rings or other packing pieces used in rotary engines, whereby the steam or other fluid is prevented from passing the rings or pieces after they have been allowed to be pressed out by the wear of their faces. 4. In the arrangement of a valve partition and passages in combination with a steam jacket round the cylinder of a rotary engine for providing the warming up and expansion of the cylinder by steam from the boiler before starting the engine, and for other purposes. 5. In a mode of applying and securing the cylinder heads to the cylinder, whereby facility is afforded for the adjustment of the heads, so as to compensate for any unequal expansion of the cylinder, and to prevent the piston drum and pistons from binding in the cylinder. *Patent completed.*

2929. H. C. Meyer. *Improvements in the means of stopping or retarding railway and other carriages.* Dated Nov. 22, 1861.

Here the inventor uses the weight of the carriages or their motive power as break power. To this end he shifts or turns the axles or bearings, and uses eccentric axles or eccentric bearings. Or he lowers or raises the bearings by any other motion. Or he reverses the eccentric axles or eccentric bearings generally, thus forcing the wheel towards a break fixed on the body of the carriage. Or he lowers the body of the carriage (with fixed stay and breaks) on to the rails or roadway. *Patent abandoned.*

2930. W. Hirst. *Improvements in the manufacture of paste, which is also applicable for sizing purposes.* Dated Nov. 22, 1861.

This consists in dispensing with the use of wheat flour, and using instead a combination of rice flour and barytes, or pea meal and barytes, for the purposes of pasting. *Patent abandoned.*

2931. A. F. Yarrow and J. B. Hilditch. *Improvements in locomotive steam carriages for common roads.* Dated Nov. 22, 1861.

This consists in an arrangement of outside cylinders, the connecting rod being coupled on to the crank of the driving axle. The cylinders are bolted to the framing, which runs the whole length of the carriage. The bearings of the axle are supported by springs, and on the outside of the bearings are the driving wheels, and on the outside is fixed a crank to which the connecting rod is coupled; or the driving wheels and crank may both be placed outside the bearings. To each bearing is attached one or more links, the other extremities of which are connected to the main framing of the carriage, or to the steam cylinder itself, by which means the proper distance between the driving axle and cylinder is maintained, and also play allowed to the springs. The second part of the invention consists in the general arrangement of the said steam carriage. *Patent completed.*

2932. W. Ambler. *Improvements in the manufacture of loom pickers.* Dated Nov. 22, 1861.

This consists in forming loom pickers of metal, adapted to receive a padding of sizing, or other suitable material combined sometimes with an india rubber back, for elasticity where they strike the end of the shuttle. *Patent abandoned.*

2933. R. DeClerq and E. Chaselles. *Improvements in apparatus for raising and supplying water to boilers, and for other purposes.* Dated Nov. 22, 1861.

This consists in certain improved arrangements of automatic apparatus for raising and supplying water to boilers, or other purposes. The patentees use two separate vessels, one as a supplementary vessel for supplying the water for condensating the steam in the other, and both acting simultaneously for drawing up the water, so that the supplementary vessel may always remain full when the steam forces the water from the other vessel into the boiler or reservoir. The details of the invention are voluminous. *Patent completed.*

2934. G. J. Farmer. *Improvements in machinery or apparatus for polishing shoe heels, toe plates, and other articles.* Dated Nov. 22, 1861.

The inventor constructs a suitable frame of wood or iron, at the upper part of which a polishing bob or wheel is mounted in suitable bearings (capable of adjustment), the surface of the bob being dressed or prepared with glue and emery; motion is given to the polishing in any convenient manner so as to cause it to rotate at a high velocity. Below the polishing a strong leather or other band is caused to travel slowly around pulleys supported in bearings (also capable of adjustment) carried by part of the main framing. The shoe heels, toe plates, &c., to be polished, are held upon the surfaces of the endless band, whilst passing under the bob to be polished, by small pieces of metal rivetted or otherwise fastened to the surface of the band. *Patent abandoned.*

2935. T. W. Davenport and S. Cole. *Improvements in the manufacture of compositions to be employed for many purposes in connection with the useful arts and manufactures.* Dated Nov. 22, 1861.

Here the patentees take paper or papier mâche, or dried paper pulp, and reduce it to fine powder; this powder is then to be mixed with some or all of the following ingredients—glue, paste, gas-tar, black-tar, varnish, copal varnishes, pitch, resin, and gold size, and a small quantity of oil, the desired articles being formed by suitable moulds. The above may be considerably varied, and suitable colouring matters introduced into the composition. *Patent completed.*

2936. T. W. Davenport and S. Cole. *Improvements in apparatus or machinery to be employed in the manufacture of ornamental and useful articles in papier mâche.* Dated Nov. 22, 1861.

Here the inventors place a cutting tool similar to a brace bit, in a chock upon the end of a spindle of a lathe, and the papier maché, of which the article is to be formed, they place in front of the back slide rest of the lathe. The material is then advanced to the cutting tool upon the spindle, which operates upon one half of the thickness of the papier mâché panel; the panel is then reversed and the cutting tool operates upon the other side of it, cutting through the other half, and thus forming the article complete, with the exception of sand papering off the slight edge that is left upon article. *Patent abandoned.*

2937. C. Bartholomew and J. Heptinstall. *Improvements in making circular blooms, such as are used in the manufacture of tyres and for other purposes.* Dated Nov. 22, 1861.

In making a circular bloom of iron, after the iron is made and rolled into a puddled bar, it is then cut into segments or radial pieces—that is to say, the puddled bar is divided into pieces of equal and comparatively short lengths by cutting it across at an angle, the cuts being made to slope alternately in either direction, and so that if the pieces be laid round in a coil or circle, their longer sides outwards and shorter sides inwards, they will butt accurately end to end and make up a complete polygonal ring. The mode in which the pile is made for the bloom from these segments or radial pieces is as follows:—A smaller bar of iron of sufficient length is coiled round a mandril, so as to produce a flat coil of sufficient width to form the top and bottom of the intended pile. Upon the bottom coil a circle of the pieces of flat bar above named is placed, and upon that circle another circle of pieces is built, so as to break joint with the pieces below, and then another circle of such pieces of iron is placed, likewise breaking joint, until a sufficient thickness is obtained. Upon the whole a top coil similar to the bottom coil is placed, and the pile is then completed ready to be placed in the ball furnace, and when it has attained sufficient heat, it is then placed in a die of the requisite form for producing the bloom of the required outside shape, when it is struck by a steam or other hammer of the requisite power and weight to thoroughly weld the pile into the required form. The die is formed of a circular hoop of iron of requisite strength and depth and cross section, according to the intended form. After the bloom has been struck in the die, a punch of wrought iron is struck into the middle of the bloom to form the inner surface, according to the inner shape desired, and to consolidate the iron laterally, and the whole is sufficiently hammered for thorough consolidation. *Patent abandoned.*

2938. E. Peyton and W. F. Batho. *Improvements in laths for supporting bedding and cushions in bedsteads, couches, sofas, and seats.* Dated Nov. 22, 1861.

This invention consists in constructing elliptical laths, each separate lath being composed of two strips of metal united or brought together at their two ends and bowed towards the centre; between the two strips the patentees fix hoops of steel, volute or other metal spring or springs, to constitute spring laths for supporting bedding, cushions, and seats. *Patent completed.*

2939. W. Evans. *Improvements in obtaining motive power by machinery.* Dated Nov. 22, 1861.

This invention is carried into effect as follows. To a horizontal bar the inventor connects at each end a rod, each of which rods is connected to a crank on a toothed spindle, upon the axis of which fly wheels are fixed. The toothed

Digitized by Google

spindles drive toothed wheels, upon the axis of which spindles carrying tappets are fixed. Then from the horizontal bar he suspends a pendulum or heavy weight, and at each end of the course of the pendulum he places a hammer or spring. The action is as follows:—He causes the horizontal bar to rock and set the pendulum in motion; through the connecting rods the crank spindles and fly wheels are made to revolve, and through the toothed wheels the tappet wheels are also made to rotate, and the motions are so calculated that upon the pendulum reaching the end of its course, first in one direction and then in the other, the tappets release the hammers or springs, which, falling or pressing on the pendulum, keep up its action. The motive power is taken from the fly wheel shafts, or from the rocking bar, or from both. *Patent abandoned.*

2940. M. Henry. *Improved means of rendering steam-tight the opening for the passage of the piston rod through the cylinder cover in steam engines, which means are applicable also to other parts of steam engines, and parts of other engines, machines, and apparatus, for the rendering thereof steam-tight and fluid-tight.* (A communication.) Dated Nov. 22, 1861.

For the purpose of this invention a movable metallic box, socket, tube, or tubular piece—hereinafter, to avoid repetition, mostly called packing or surrounding appliances—is fitted or placed at the part to be rendered steam or fluid-tight, so as to surround the piston-rod or other article to which it is applied, and is so arranged as to effect or answer the purpose of a packing, that is to say, to keep the parts steam-tight or fluid-tight, or to obtain steam-tightness between the surfaces. The said packing or surrounding appliance may be made in one or more parts or pieces, and the passage formed through or in it for the reception of the piston-rod or other article that it surrounds may be bored so as to present smooth sides or surfaces, or such sides or surface may be formed with grooves round the same. *Patent completed.*

2941. S. Sansum. *An improvement or improvements in penholders.* Dated Nov. 23, 1861.

This consists in making penholders wholly of metal, each holder being made of one piece of sheet metal bent into the form of a tube. *Patent abandoned.*

2642. M. A. F. Mennons. *An improved apparatus for the multiplication of motive power.* (A communication.) Dated Nov. 23, 1861.

This consists in the construction and application to motive engines of an auxiliary lever apparatus, the object of which is to multiply the working power by correcting the too feeble radius of the cranks, and the reduced effort exerted thereon, by the direct action of the driving pistons. The invention is not described apart from the drawings. *Patent abandoned.*

2943. C. H. J. W. M. Liebmann. *Improvements in textile and felted fabrics.* Dated Nov. 23, 1861.

This consists in the application of felt to textile or woven fabrics, or in combining felted fabrics with woven fabrics; either by the process of felting fibrous substances on to or into the surface or surfaces of woven fabrics, or by laying a felted fabric and a woven fabric together, and causing them to adhere by the process of felting or other suitable means. *Patent abandoned.*

2944. J. Weems. *Improvements in the manufacture of metallic tubes, and in coating or plating metals.* Dated Nov. 23, 1861.

This relates to the manufacture of metal tubes with the view of producing a cheap substitute for brass or other similar tubing. Under one modification zinc tubes are formed by passing the metal strips through dies or rollers, and the overlapping or contiguous edges of the metal are bronzed or soldered with the aid of the blow pipe. The tube may then be passed through a die to impart a smooth finish thereto. The tube is then to be coated with copper, either by means of a galvanic battery, or by immersion in cold or heated solutions of the salts of copper, suitable for precipitating the metallic base upon the surface of the tube. These tubes may also be coated with compound solutions of metals, so as to deposit a metallic alloy upon the surface of the tube; or its surface may, if preferred, be coated with tin and its alloys, or be bronzed or lacquered. *Patent completed.*

2945. J. H. Johnson. *Improvements in toothed wheels, and in the apparatus used in their manufacture.* (A communication.) Dated Nov. 23, 1861.

This relates to a peculiar manufacture of toothed wheels and pinions, and consists in moulding such gearing from sheet india-rubber in suitable moulds, the india-rubber moulded wheel or pinion being afterwards hardened in the usual way. *Patent completed.*

2946. R. A. Brooman. *An improved cup or vessel for administering liquids.* (A communication.) Dated Nov. 23, 1861.

The difficulty of drinking out of a glass or cup when in a recumbent position, and of giving drinks to children on the knees, or in bed, has given rise to the present invention. This improved vessel is formed with a curved spout, made to project from the lower part thereof, the outflow from which is regulated by a stopper carried on the end of a lever and kept in contact with the mouth of the spout by a spring, and which is released to the extent required by depressing the tail of the lever; or a stop-cock is fixed in the spout, or the spout is opened and closed by a plug fitting into or over the passage where it springs from the vessel, the plug being worked by a stud outside the vessel, connected to a rod to one end of which the plug is fixed. *Patent abandoned.*

2947. J. Pitkin. *Improvements in aneroid barometers.* Dated Nov. 23, 1861.

This invention consists in jewelling the axes of the working parts of the mechanism of aneroid barometers, and in inserting jewelling in the hole through which the spindle which carries the needle passes, so that the spindle shall be entirely surrounded by the ruby, or other stone, of which the jewelling is composed. And for the protection of the glass of portable aneroid barometers, the inventor applies a spring cover similar to the cover of a watch. *Patent abandoned.*

2948. W. Bray. *An improved locomotive apparatus, particularly adapted to agricultural purposes.* Dated Nov. 23, 1861.

This consists in supporting the boiler or boilers and machinery consisting of one or two engines, combined with gearing &c., of locomotive carriages upon or over one axle, which thereby supports the entire weight thereof, and in making the main axle in two parts, but connected in a box the width of the carriage, so that, when put together, it shall act as a solid axle; and in arranging the upper carriage body so that the front portion thereof may be moved by steering apparatus, and be turned from its straight position, with regard to its hind portion, by a suitable locking plate; and in arranging the entire upper carriage body upon an under carriage or frame, reaching from end to end, and in and by means of which under carriage and its toothed gearing and the locking plate, the front portion of the upper carriage is caused to be steered or turned from its direct course by the main or driving wheels and axle. Also in furnishing the main axle with cranks close to or near the main wheels, so that the axles of these wheels are removed from the centre of the main axle, in order that the position of the wheels may be changed in relation to each other, according to circumstances, by varying the position of the cranks on the axes or centres of which they are caused to turn by the driving rim or wheel. Also in the arrangement of the driving rims or wheels in connection with main wheels or on other axles, by causing such rims or wheels to be detached from the main wheels, and to operate upon fixed hollow axles or bearings, whereby their position remains unchanged, whatever be the position of the main wheels. *Patent completed.*

2949. E. A. Rowviere. *An improved pump.* Dated Nov. 23, 1861.

This consists in the use of two pistons of different diameter, which are firmly secured to each other and work together in a pump barrel composed of two barrels of portions of different diameters, so that, as the pistons move or travel in their respective barrels, the capacity of the space compressed between them—that is to say, the space or portion of the pump bounded by the pistons, and the sides of the pump barrels, shall be continually undergoing variation, being either increased or reduced according to the directions in which the pistons travel—that is to say, when the direction of the piston's motion is such that the larger piston is moving towards the smaller barrel, and the smaller piston is receding from the larger barrel, the capacity of the said space is contracted or reduced; and when the pistons move in the reverse direction, the capacity of the said space is increased or enlarged, by which the forcing and suction of the water or liquid is effected. *Patent completed.*

2950. P. De Wylde. *Improvements in paper making machinery.* (A communication.) Dated Nov. 23, 1861.

This consists, 1, in forming the channels of the plates in the segmental bed in lines running diagonally across the same, and at an angle (greater or less) with the axis of the cylinder; and in place of rounding or fleeting the edges of the grooves, square or slightly angular projections are substituted for rough or half stuff; an angle of about 45° is preferred, and for fine stuffs the channels are cut, or the projections formed at an angle of about 22°. 2. In forming the rubbing surfaces between which the raw materials are triturated, chased in one or both directions, similar to the surface of a single cut file, making the chase in a zig-zag line across the length of the plate. 3. In placing the blades on the periphery of the cylinder in an oblique line, so that the edges of the blades form a curved and slightly spiral line, or by forming the said blades in a series of parallel curves or zig-zag series, the rubbing surfaces being either chased or plain, and square or slightly angular. *Patent completed.*

2951. V. Penoard, Jun. *Improvements in surface condensers.* Dated Nov. 25, 1861.

This consists, 1, in a particular mode of attaching the tubes of such condensers to the plates through which their ends pass, and by which the said tubes are supported. 2. In the adoption of diaphragms for regulating the course both of the steam passing into the condensers, and also for regulating the course of the water used for causing condensation. 3. In the materials of which the condenser or parts of it are composed. 4. In the modes of arranging and fixing the tube plates so that any section or stack of tubes can be readily removed for repair, the condenser being still left in a state more or less complete and fit for use. *Patent abandoned.*

2952. J. B. Hulard and L. G. Poupet. *An improved process for hardening stones and plaster of Paris, and making them impervious to water.* Dated Nov. 25, 1861.

The composition which the patentees prefer for their indurating liquid is composed of the following ingredients in certain proportions:—Borax, white lead, sulphur of alumina, acetate of lead, sulphate of zinc, silicate of soda or potash, ravlin, linseed oil, and water. *Patent completed.*

2953. J. Macintosh. *Improvements in obtaining and applying motive power, and in apparatus connected therewith.* Dated Nov. 25, 1861.

This consists, 1, in obtaining power for propelling vessels and carriages, by the momentum or impulsive force of jets or blasts of steam conveyed through pipes from the boiler or boilers, issuing through orifices or injectures alone or in combination with fluid or liquids impinged against inclined surface. The second part of the invention for obtaining power consists in attaching a series of plates in an inclined position on a hollow shaft mounted on bearings and furnished with stuffing boxes; the steam is conveyed from the boiler to the shaft by pipes issuing through orifices under the inclined plates, causing the shaft to revolve, the whole being enclosed in an outer casing, through which the waste steam passes. Third, in fixing a series of metal plates or boards on a long shaft with bearings, and secured with a frame, which may be wholly or partially immersed in running water which impinges against the inclined plates or boards, causing the shaft to revolve, from which power is obtained. *Patent completed.*

2954. G. Lowry. *Certain improvements in machinery for carding and hackling flax, tow, and other fibrous substances.* Dated Nov. 25, 1861.

The first part of this is applicable to carding engines having working and stripper rollers, or carding rollers, and consists in a peculiar combination, application, and adoption of parts for removing the fibrous and other impurities from the rollers, for collecting them in suitable receptacles, and removing them therefrom. The second part is applicable to sheet hackling machines, and consists of arrangements and combinations of parts for stripping the loose tow from the hackles and from the stripping rods. The invention is not described apart from the drawings. *Patent completed.*

2955. J. Ronald. *Improvements applicable to machinery used for spinning hemp, flax, manilla, wool, and like fibrous material, and for the manufacture of topped-up, formed, or laid thread, twine, cord, line, cable, and other cordage.* Dated Nov. 25, 1861.

The patentee claims, first, the peculiar arrangement and use of a pair of drawing or nipping rollers, mounted parallel and in close proximity to each other within a revolving frame when applied to spinning machines. Second, giving a reciprocating motion to the flyer of the take-up yarn bobbins of the spinning machines, as described, and the peculiar arrangement of parts for accomplishing the same. Lastly, the use of the horizontal revolving drawing roller frame, and its adjuncts, for putting in the first part of the lay when applied to topping machines having the yarn or strand bobbins and the take-up bobbin arranged vertically. *Patent completed.*

2956. J. Goudie. *Improvements in reefing and stowing the sails of vessels.* Dated Nov. 25, 1861.

In or near the centre of the sail the patentee proposes to place, longitudinally and parallel to the main and top sail yards, a boom or extra yard; on each end of this boom he places a casing to protect and guide the operation of the rolling tackles and down haul. The rolling tackles passing through blocks or sheaves at the ends of the top sail yard descend to the ends of the boom round which they wind; the down haul leads thence to blocks or sheaves at the ends of the main yard, thence to blocks attached to and under the centre of the top sail yard, from whence the down haul descends to the deck to be belayed in the usual way. *Patent abandoned.*

2957. W. Burgess. *Improvements in reaping and sowing machines.* Dated Nov. 25, 1861.

This invention will be specially noticed in a future number of this journal. *Patent completed.*

2958. J. Willcox. *Improvements in sewing machines.* (A communication.) Dated Nov. 25, 1861.

The patentee claims, 1, the general construction and arrangement of sewing machines and apparatus used in connection therewith, substantially as described. 2. The application and use to and in sewing machines of a revolving loop retainer or tension "let off," in combination with a rotatory hook or looper, and an eye-pointed needle, as described. 3. The application and use of leather or other sound-deadening material interposed between those parts of the feed mechanism of sewing machines which strike against or come in contact with each other when at work, to prevent noise, as described. 4. The system of producing a self-acting intermittent action of the needle thread, as described. 5. The making of the hole through which the needle works in a separate piece of metal secured to the cloth plate, and carrying the feed surface to operate on all four sides of such needle hole, as described. 6. The combination of mechanism for driving sewing machines, as described. 7. The application and use of a double or forked connecting rod in combination with a suitable clamping apparatus arrangement for driving sewing machines, as described. 8. The application and use, in combination with a hammer of any suitable construction, of a check or adjointing plate, substantially as described. *Patent completed.*

2959. J. H. Johnson. *Improvements in machinery or apparatus for preparing oval picture frames.* (A communication.) Dated Nov. 25, 1861.

This consists, essentially, in the use of a scraper or working down tool, in combination with the force plate of an eccentric lathe, or with an elliptograph or other suitable apparatus, the scraping tool being made self-adapting to the irregularities or variations on the scraper of the frame, and its scraping edge being the reverse of the intended moulding. When an eccentric lathe is used, the oval frame is mounted upon the face plate of the lathe, and describes an oval or ellipsis when rotated, whilst the scraper remains stationary, but is held against the frame by a yielding pressure. Where an elliptograph, or other similar contrivance is used, the oval frame is laid upon a stationary bed, and the scraper is caused to travel over its surface by the action of the elliptograph, it being at the same time free to rise and fall, so as to allow of any irregularities on the surface under treatment. *Patent completed.*

2960. J. H. Johnson. *Improvements in machinery or apparatus for shelling and cleaning rice and other grain.* (A communication.) Dated Nov. 25, 1861.

Here it is proposed to use two horizontal surfaces, one of which is made to rotate in close proximity to the other, whilst the other surface is held stationary. The rotating surface is intended to be covered with india-rubber, gutta-percha, or other material, and the stationary surface is composed of stone; provision is made for adjusting the distance between the two surfaces, so as to suit the grains of different size. *Patent completed.*

2961. A. V. Newton. *An improved method of removing and preventing the formation of calcareous and saline deposits in steam boilers.* (A communication.) Dated Nov. 25, 1861.

The patentee claims the use of tobacco, or a decoction of the same, for preventing the incrustation of steam boilers, or of removing the scale therefrom. *Patent completed.*

2962. J. Halford. *Improvements in collecting and utilising smoke, gases, and such like products of combustion, rendering the same available for heating steam boilers, and other purposes where heat is required, which improvements* *are also applicable to the desulphurisation of coal in making coke.* Dated Nov. 25, 1861

In applying this invention to coke ovens, or open coke fires or heaps, instead of the chimney or chimneys now ordinarily constructed, the inventor constructs a close built or solid chimney which is closed at the top. Through the top he leaves holes which encircle it placed at such distances apart as may be required. This said chimney is enclosed in another of the same kind, as is now usually made use of, or one constructed in any way so as to draw off the smoke and other combustible products of the coal. He either connects this outer chimney with the inner one at the top or not, according to circumstances. The outer chimney has the effect of drawing off the smoke, gases, and such like products, from the burning coal, and conveying the same to the holes near the top of the solid chimney, through which they ascend into a pipe or flue, which he constructs at the bottom of the fire, either on or under the surface of the ground, and which is either extended to the place where the heat is to be applied, or discharges itself into a main flue or pipe. *Patent abandoned.*

2963. G. Clarke. *An improved fire-escape.* Dated Nov. 25, 1861.

This consists in forming a balcony of sheet iron, and applying it to a window so that it shall be capable of containing a few persons and lowering them safely in case of fire. *Patent abandoned.*

2964. P. Cowan. *A mode of utilizing the waste heat of furnaces used in reburning animal charcoal.* Dated Nov. 25, 1861.

Here the patentee applies to, or combines with, the furnace in which the cylinders, vessels, or retorts are fitted and heated, or to or with the flues communicating with such furnace, a boiler or generator in such position as to be exposed to the action of the waste heat of the furnace, so that, if desired, steam shall be generated in such boiler or generator simultaneously with the carrying on of the process of reburning the charcoal. *Patent completed.*

2965. A. W. Willis. *Improvements in the construction of pencil cases or holders.* Dated Nov. 26, 1861.

This consists in forming a tube of the desired size, open at both ends and having a slot down one side thereof. A small metal cylinder is arranged to work within the tube having on one end two or more pins or points fixed vertically, these or pins points work in the tube. A knob is fixed on one side of the cylinder, such knob working in the slot so as to cause it to work up and down. The pencil is held between the pins or points, and is introduced into the tube at the end where the slot commences. *Patent completed.*

2966. C. G. Braxton. *Improvements in propelling and steering vessels.* Dated Nov. 26, 1861.

The inventor runs a shaft from the engine room, under the beams, and through the stern post, also one from the engine room forward, through the stem, about two feet under water, and working in contrary directions. On the outer end of the shaft he fixes a paddle with two blades, in form like the blade of an oar, in such manner that it may be taken on and off very easily by the crew, as he does not intend the one at the stem shall be used except in light winds and in a calm, or when the stern one is used for other purposes; in such cases he intends it to steer the ship alone; the engineer to work it and steer the ship in the engine room, receiving orders from the officer of the watch by means of a tube from the deck. In case the ship is short of coals, and in a calm, he unships the stern paddle and puts on a screw to propel the ship, and steers by the bow paddle alone; and for the purpose of driving this screw he attaches several winches to the upright under each beam, driving the shaft both above and below, so that any number of men may heave by several handles to take off and on at any part of the ship. This he intends principally for sailing ships and transports. Boats, also, may be propelled by the same means, the handle working between each thwart. *Patent abandoned.*

2967. J. Brown. *Improvements in fire-bars and furnaces.* Dated Nov. 26, 1861.

This consists, 1, in manufacturing fire bars in several parts, which the inventor calls clumps. 2. In a novel shape for the ash hole or fire-place. This is done by making it bell mouthed, and with a door to fit the mouth of the fire-place or ash hole, working on a bar that extends across the mouth of the ash hole, and forms a damper, and regulates the generating of steam. *Patent abandoned.*

2968. I. Davies. *Improvements in the construction of roofs for dwelling houses, horticultural erections, and other buildings.* Dated Nov. 26, 1861.

The inventor constructs the roofs of dwelling houses, warehouses, sheds, &c., by forming the outer edge of the rafts, or of, say, every alternate rafter, with one or more grooves or channels, which he covers with sheet lead or other metal. Over these, without the interposition of battens, he places the slates, tiles, stones, &c., made of such a size that in their vertical course their edges shall abut against each other, just over the grooves or channels, to allow these latter to convey away water. In their horizontal course each succeeding one overlaps the other, and carries the water downwards in the usual way. *Patent abandoned.*

2969. R. Harcourt. *An improvement or improvements in fastening knobs to doors, drawers, and other articles; and in connecting knobs to spindles.* Dated Nov. 26, 1861.

This consists in fastening knobs to doors, drawers, &c., and in connecting knobs to locks or other spindles, by a divided collar or plate, which is made to engage with the flange or shoulder which terminates the neck of the knob, or to engage with the neck of the knob. The invention is not described apart from the drawings. *Patent completed.*

2970. W. Sellers. *Improvements in means or apparatus for sewing.* Dated Nov. 26, 1861.

This consists in operating the needle by its cam or tappet, so that when the shuttle enters the thread on the needle, the needle may have a slight back motion given to it, sufficient to admit of the shuttle passing through without drawing off more thread than required for the passage of the shuttle, by which facility is given for using a much greater range in sizes of needles and thread in the machine, and of sewing greater varieties of work. *Patent abandoned.*

2971. C. Stephens. *Improvements in penholders.* (A communication.) Dated Nov. 26, 1861.

This invention is not described apart from the drawings. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated April 17, 1862.

1116. A. Krupp, Essen, Prussia, cast steel manufacturer. Certain improvements in the manufacture of screw propellers.

Dated April 29, 1862.

1247. J. W. Caley and F. G. Caley, New Windsor, silk mercer. An improved textile fabric.

Dated May 2, 1862.

1299. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in apparatus for superheating steam. (A communication.)

Dated May 9, 1862.

1387. G. F. Greiner and J. H. C. Sandilands, 1 Golden-square, pianoforte maker. Improvements in the construction of pianofortes.

1388. T. McIlroy, Brampton, Canada West. An improved invalid bedstead.

1391. W. Eddington, jun., Chelmsford, engineer. Improvements in portable grinding, chaff-cutting, and corn-crushing machinery.

1392. F. F. B. Mayall, Warrington, Lancaster, dyer. Improvements in dyeing mixed or plain fabrics and yarns.

Dated May 13, 1862.

1443. W. Clark, 53 Chancery-lane, engineer. Improvements in apparatus for generating motion in fluids, applicable for raising and forcing water, propelling and otherwise in the distribution of motive power. (A communication.)

Dated May 14, 1862.

1451. H. C. R. Joubert, upholsterer, 18 Maddox-street. Improvements in raising music chairs, stools, or seats.

Dated May 16, 1862.

1486. F. B. Anderson, Birmingham, manufacturer. Improvements in watches and other time-keepers.

Dated May 19, 1862.

1512. F. C. Kirkman, Crouchend, Hornsey, and Richard Swift, Hounslow, civil engineers. A new and improved joint for uniting or fixing posts and rails of bedsteads and other articles of furniture, posts, and rails in fencing, in the construction of framework for conservatories, emigrants' and other portable houses.

Dated May 22, 1862.

1542. E. De la Bastida, 43 Hart-street, Bloomsbury-square. A new process for the production of designs in relievo, and in deepening on sheets of india-rubber of any length whatever. (A communication.)

1544. J. Needham, Piccadilly, gun-maker. Improvements in breech-loading fire-arms, and in cartridges for such fire-arms.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1646. J. Betteley, Liverpool, iron-merchant. Improvements in ship building, and in rendering ships shot proof. Dated May 31, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

143. T. W. Jobling. Adaptation of locomotive engines to traction or haulage in mines.

229. J. H. Brierley. Clasp or fastener.

233. D. Littlehales. Plastic compound.

234. H. White. Shirt collars.

237. H. Schatteo. Gas meters.

262. P. Scheurweghs and A. J. A. H. De Boisserolle. Treating fatty and oily matters.

270. L. Fauvel. Indicating the existence of escapes in gas tubing.

278. T. Cook. Folding envelopes.

280. F. Riesbeck and W. Becker. Locks or fastenings.

281. C. W. Lancaster. Strengthening cast iron ordnance.

295. J. Greenwood. Preparing and combing fibres.

297. J. Webster. Gas fittings.

299. D. Gallafent. Generating or producing elastic vapours.

301. H. Ashworth. Spinning cotton.

316. M. Henry. Obtaining and applying motive power. (A communication.)

320. J. Tonkin. Manufacture of gunpowder.

322. R. A. Brooman. Stereoscopic albums, books, and cases. (A communication.)

330. W. H. Barthplomew. Barges or vessels.

349. W. Clark. Refining iron. (A communication.)

367. J. Brickhill. Cylinders and pistons of steam engines.

4[illegible]. W. Clark. Feeding or supplying steam boilers with water. (A communication.)

517. A. Stephen. Construction of ships or vessels.

539. T. Bray. Ornamenting wood.

560. M. and A. Gabriel. Artificial teeth.

565. S. G. Reynolds. Power spading machines.

662. G. Davies. Attaching artificial teeth. (A communication.)

697. W. E. Newton. Armour plates. (A communication.)

866. E. T. Nouathier. Ventilator.

928. A. V. Newton. Bits for taming or subduing vicious horses and breaking colts. (A communication.)

1029. G. D. Mertens. Making beer. (A communication.)

1146. W. Rose. Manufacture of tubes.

1183. J. H. Johnson. Taking deep sea soundings. (A communication.)

1455. H. Deacon. Production of certain colours.

1517. A. B. Childs. Wringing machines. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated June 6, 1862.

3083. R. A. Brooman.
3087. W. Clark.
3093. J. A. J. Redier.
3099. D. Vogl.
3109. J. Potter.
3110. J. Leeming.
3113. W. Lightfoot.
3118. A. Tonnar.
3129. J. W. Friend.
3133. P. Quantia.
3137. H. Appleby and [illegible] Harrison.
3145. J. Mc Intyre.
309. A. V. Newton.
841. W. L. Winans.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1351. S. and J. Wood and P. Billington.
1383. J. Ferrabee.
1384. W. Green.
1391. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth.
1400. A. V. Newton.
1407. M. J. Haines.
1423. H. L. Corlett.
1425. A. Smith.
1431. W. Brown [illegible] Bathgate.
1466. J. Combe and [illegible] Smallpage.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1274. G. Green.
1292. G. Hopper.
1291. J. Robertson.
1299. J. Ramsbottom.
1300. J. Boncle.
1315. J. S. Nettlefold, E. J. Nettlefold, and J. [illegible] Nettlefold.
1318. C. F. Varley.
1321. J. Robinson.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending June 7, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
2632	0 7	2647	0 3	2662	0 [illegible]	2677	0 3	2692	1 [illegible]	[illegible]	[illegible]
2633	0 5	2648	0 3	2663	0 10	2678	0 9	2693	[illegible]	[illegible]	[illegible]
2634	0 3	2649	0 10	2664	1 1	2679	0 [illegible]	2694	[illegible]	[illegible]	[illegible]
2635	1 8	2650	1 4	2665	0 3	2680	0 10	2695	[illegible] 3	[illegible]	[illegible]
2636	0 6	2651	0 3	2666	1 6	2681	0 3	2696	[illegible]	[illegible]	[illegible]
2637	0 4	2652	1 0	2667	0 3	2682	0 5	2697	[illegible]	[illegible]	[illegible]
2638	1 6	2653	0 3	2668	0 9	2683	0 8	2698	[illegible] 10	[illegible]	[illegible]
2639	0 6	2654	1 2	2669	0 9	2684	1 5	2699	[illegible]	[illegible]	[illegible]
2640	0 7	2655	0 3	2670	0 3	2685	0 9	2700	[illegible]	[illegible]	[illegible]
2641	0 3	2656	0 11	2671	2 5	2686	0 6	2701	3 2	[illegible]	[illegible]
2642	0 6	2657	0 6	2672	0 3	2687	0 3	2702	[illegible]		
2643	1 1	2658	0 3	2673	1 3	2688	0 3	2703	[illegible]		
2644	0 5	2659	0 3	2674	0 1	2689	0 3	2704	[illegible]		
2645	0 3	2660	0 5	2675	0 3	2690	1 3	2705	[illegible]		
2646	0 7	2661	0 4	2676	1 4	2691	[illegible]	[illegible]	[illegible]		

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, June 12, 1862.

		£	s.	d.		£	s.	d.
IRON:								
Bars in Wales and North of England	pr.ton	6	0	0	to	6	[illegible]	[illegible]
Welsh Bars, in Wales	„	5	5	0	„	5	[illegible]	[illegible]
Staf. Bars, at the Works	„	7	0	0	„	7	[illegible]	[illegible]
„ Hoops	„	7	10	0	„	8	[illegible]	[illegible]
„ Sheets, Singles	„	9	0	0	„	10	0	[illegible]
„ Nail Rods	„	8	15	0	„	[illegible]	10	[illegible]
„ Boiler Plates	„	8	0	0	„	8	10	[illegible]
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2	10	0	„	2	14	0
Do. No. 1, Good Brands	„	2	11	6	„	2	15	0
Scotch Bars	„	7	5	0	„	7	15	0
Swedish Bars, in London	„	10	10	0	„	11	[illegible]	[illegible]
COPPER:								
Sheet and Sheathing	per lb.	0	0	11	„	0	0	[illegible]
Tough Cake and Tile	pr.ton	96	0	0	„	0	0	0
Best Selected	„	101	0	0	„	0	0	0
Australian	„	99	0	0	„	0	0	0
South American	„	0	0	0	„	0	0	0
Yellow Metal Sheathing	per lb.	0	0	0	„	0	0	0
STEEL.								
Swedish Keg	pr.ton	15	0	0	„	0	0	0
„ Faggot	„	16	0	0	„	0	0	0
TIN:								
English, Block	p.cwt.	6	0	0	„	0	0	0
„ Bar	„	6	1	0	„	0	0	0
Foreign, Banca	„	6	4	0	„	0	0	0
„ Straits	„	5	17	0	„	0	0	0
TINPLATES:								
Charcoal, I.C.	pr.box	1	7	0	„	1	0	0
Coke, I.C.	„	1	1	0	„	1	[illegible]	0
LEAD.								
Pig, English	pr.ton	20	0	0	„	21	0	0
„ Spanish	„	19	10	0	„	19	15	0
Common Sheet	„	21	0	0		0	0	0
Tea „ (Wimshurst's Patent) A special discount	„	35	0	0	„	0	0	0
SPELTER:								
On the spot	„	17	10	0	„	18	0	0
For arrival	„	17	10	0	„	17	15	0
ZINC.								
English Sheet	„	23	0	0	„	0	0	0
QUICKSILVER	pr.btl.	7	0	0	„	0	0	0

JAMES LAURIE, Metal Broker,
50 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 20, 1862.

INTERNATIONAL EXHIBITION OF 1862.

ELECTRIC TELEGRAPHS AND ELECTRICAL APPARATUS.

[SECOND NOTICE.]

THE machines of various kinds which serve for the conversion of electric force into human language may be classified as follows, viz.:—Into needle telegraphs, whose communications are made by the oscillations of one or more magnetic needles, to the right or left, at the will of the operator, a specific number of such movements being appropriated to each letter or figure, and agreed upon as its representative to the eye of the receiver. "Dial," or "step-by-step," telegraphs, in which a pointer, like the hand of a clock, turning on its axis in the centre of a circular dial is caused to indicate any desired letter inscribed around the circumference of the latter. Recording telegraphs, wherein combinations of dots and strokes, indented or otherwise marked upon ribboned paper, are made to represent each character in the alphabet. Printed telegraphs, whose signals are produced in plain printed type. And, finally, acoustic telegraphs, or electricity made vocal, on which plan correspondence is carried on by sound alone.

Of needle telegraphs (the class of instruments chiefly made use of in this country), there are several exhibitors; but their specimens display little that is novel. The British and Irish Magnetic Telegraph Company show the single needle instruments of the late Edward Highton, who was the first to bring into practice the use of one line wire in connection with them, so as to obtain a result in working power equal to that of the old system of double wires and needles. Messrs. Reid Brothers exhibit the double-needle system, as used by the Electric and International Company. Mr. Cornelius Varley shows an improved double-needle instrument constructed on what is termed the "silent" principle. The axle is one solid piece of metal; the usual form of axle being composed of two pieces joined together by wood for insulation, and consequently very liable to derangement from warping. The blocks on which the handles strike are made very firm and solid. The instrument altogether is calculated to stand more ill-usage than most other descriptions.

Of dial telegraphs, all the specimens exhibited are exquisite pieces of workmanship. It may be doubted whether this system could be made practically available for telegraphing to any considerable distance; but it is admirably adapted for the purpose to which it is being extensively applied by the Universal Private Telegraph Company, recently established for erecting and maintaining, at small fixed annual rentals, private lines of communication in large towns, for the use of persons desirous of having several places of business brought within speaking distance of each other. The instrument exhibited by this company is the invention of Professor Wheatstone. It consists of two distinct parts, the "communicator" for sending, and the "indicator" for receiving messages. The communicator contains a permanent horse-shoe magnet, at the poles of which are placed electro-magnetic coils. An axis, bearing a soft-iron armature, and connected to wheelwork, moved by a handle external to the box, is made to revolve so as to pass rapidly over the poles of the magnet, inducing thereby currents of electricity moving alternately in opposite directions through the wire of the coils and along the conducting line to the distant indicator. Externally the communicator has on its upper surface a fixed dial divided into thirty spaces, twenty-six for the alphabet, three for punctuation, and one for zero. An inner circle marks the nine digits. A pointer in the centre rotates by mechanism, and stops, at the will of the operator, opposite the letter he desires to send. Around the outside of the dial are thirty small depressible keys or buttons, one for each sign; these being depressed in succession, will, by means of internal mechanism, each liberate one current or thirty distinct currents during an entire revolution of the hand from button to button round the dial. For every current thus transmitted, the pointer of the communicator and that of the indicator at the distant station will simultaneously advance step by step until they reach the letter opposite the depressed key or button.

The indicator, a beautiful instrument resembling a small clock, has inscribed on its face the same letters and numerals as the communicator, and its hand receives its motion, synchronous with that of the latter, by means of an electro-magnetic apparatus, consisting of two magnetic needles, fixed to an axis and lying parallel between two small coils with soft iron cores. When a current passes through these latter they attract or repel the poles of the needles, giving to the axis to which those are fastened a backward and forward motion, alternating with the positive and negative currents, which under this system are sent in turns. A short arm carrying an escapement wheel of fifteen teeth (the axis of which latter is also that of the pointer) is fixed vertically to the axis of the needles, and in its rotation working to and fro against fixed stops or pins, imparts to the pointer a steady step by step motion. An obvious advantage possessed by this form of instrument is the ease with which it is worked—no previous training being required, as is the case in telegraphy by arbitrary signals.

The other dial telegraphs exhibited are those of Mr. Wilde, of Manchester, Mr. Tyer, of the District Telegraph Company, Mr. C. W. Siemens, and Mr. Henley. They are all generically the same as Professor Wheatstone's instrument, the germ of which was shown by him in King's College, twenty years ago, but in their details they present important variations. The communicator of Mr. Wilde, for instance, differs in mechanical arrangement from the Wheatstone arrangement, as do also those of Siemens and Henley, while in the case of Mr. Tyer's instrument, the primary power employed is galvanic instead of magnetic electricity.

The recording telegraphs next claim attention. These, in some form or other, are the class of instruments in all but universal use everywhere, except in Great Britain, and for most of the submarine business even here. We have accordingly many very beautiful and interesting varieties of them which are for the most part matchless as regards perfection of manufacture. The parents of this system are Morse, of America, whose signals are dots and strokes, indented with an iron style upon paper, against and from which the style can be pressed and released at pleasure, by electro-magnetism, the paper itself being continually drawn forward in front of the style between rollers, moved by ordinary clockwork machinery; and Bain, of England, the general principles of whose invention much resembled that of Morse, except that his signals were obtained by using the decomposing power of the current for making marks upon chemically prepared paper.

The most interesting and advanced of these instruments at South Kensington, are those which work more or less automatically. The automatic system of Mr. Allan is especially ingenious. It consists of three machines; the punching machine is the first of these, and by this the ribbon paper to be passed through the sending machine is perforated with holes, representing dots and strokes of the Morse alphabet, at those points only where the current is required to mark on the unperforated ribbon at the receiving station; next is the sending machine, into which the perforated paper is introduced. This machine winds up its own clockwork, whereby the paper is drawn forward, and stops of its own accord when the message is completed; and lastly, the receiving instrument at the distant station, which is also so arranged as to start its own machinery on receiving the electric impulse, and stop it when the perforated paper at the other end has passed through the sending apparatus.

Professor Wheatstone's automatic recorder is another very beautiful instrument of this class. The message to be sent has to be punched out, as in the former case; but instead of using lines and dots for signals, as in the Morse system, the signals here are all dots, but are grouped above and below a line of smaller perforations, running horizontally along the middle of the paper ribbon. The punched-out message forms a sort of jacquard pattern, which is introduced into the sending instrument, and by turning a handle it is passed through it at a uniform rate; as each hole in the paper comes through the centre of the clip which keeps it even as it passes, three springs, attached to an axis in connection with the handle, rise up, but only one of these can rise through the paper, because there will only be one perforation presented at the same time. If a spring pass through one of the upper holes, a current is liberated which passes along the conductor to the receiving station. If a spring pass through the lower hole, a current of opposite electricity is produced; but if the middle spring (corresponding to the line of division) passes through an opening, no current is sent. The receiving instrument records the message thus sent as follows:—A strip of paper is drawn by a clockwork movement through the apparatus which contains two series of electro-magnetic apparatus, similar to those of Wheatstone's dial communicator, but so arranged that the axis to which the permanent magnets are attached move independently, the one for a current in one direction, and the other for its opposite. To each of these axis a thin iron style is attached; these styles, when depressed, dip through a small hole in a shallow reservoir filled with Indian ink. The holes are so small that unless this be done capillary attraction prevents the flow of ink through them. Now, as one of these styles is depressed by a negative and the other by a positive current, the ribbon, drawn as described under this reservoir by the clockwork motion, has a dot made upon it above or below the central line of demarcation, according as a perforated hole at the other end passes at the same time through the transmitting apparatus. It will consequently be seen that if this series of instruments be found in practice to work for considerable distances, with the same beautiful regularity of which it is certainly capable in theory, a very large increase in the speed of transmitting intelligence may be attainable.

The automatic system of Messrs. Baudouin and Digney, Frères, of Paris, which present some features in common with those we have described, are also well worthy of inspection, as are also several other instruments exhibited by them in the French gallery.

In the same gallery, M. Sortais exhibits a remarkable and effective machine whereby the ordinary Morse instrument can be made to start and stop itself by the electric current. The new arrangement can be added at a trifling expense to any of the existing Morse recorders. In the Austrian department is another interesting form of Morse instrument, the invention of Herr Leopolder, in which electro-magnets are employed to draw forward the ribbon message-slips, instead of the ordinary plan of wound-up mechanism.

In the Western Annex Signor Bonelli shews, in actual work, his very ingenious electro-chemical recording apparatus, which appears to carry out in a more practical form the original invention of Mr. Bakewell, of England, from which, however, it materially differs. The object of both is to produce at the distant station a fac simile of the writing or printing in hand at the sending station. This is thus accomplished by Signor Bonelli:—A portion of the staff is employed in setting up, in ordinary roman type, every message as soon as it is received; when so set up, the message is "locked" in what printers term a "form," in an elongated shape, so as to allow it to pass, as hereafter mentioned, under seven metallic springs, insulated from the manipulating table, but in connection with seven line wires. These springs, as they scrape along its surface, reproduce at a distance, by arrangements which it would occupy too much space to describe, the characters of the type, on strips of paper prepared with a solution of nitrate of manganese, over which paper another series of seven springs are drawn, these latter being in connection, by means of the line wires, with those in contact with the type. At each station the sending and receiving apparatus are arranged nearly in a line with each other, the receiving plate following the type form on a sort of platform on wheels, about three feet long by six inches wide, the type form being at one end of this platform and the brass plate for holding fast the chemical paper at the other end, but not on the same side of the platform. This latter runs on rails along the office table, and at each journey passes under a bridge, from which depend the combs or springs before referred to, for making contact with paper and type respectively. In actual work, this platform or waggon would be constantly travelling from one end of the table to the other at each station, alternately sending messages, during one half its journey, by means of the type acted on by the forwarding springs, and receiving them during the remaining half through the recording springs upon the prepared paper.

The expense of working this system must be very considerable, as it would require seven line wires to begin with, and a staff of persons to set up and distribute type, &c., for each instrument. A company has, however, been formed to bring it into use, and a line is nearly completed for them between Liverpool and Manchester.

In printing telegraphs, the only instrument exhibited is that of Mr. Jacob Brett, which is memorable historically, being the instrument by which the first message was received through the first submarine cable.

The acoustic telegraph of Sir Charles Bright and his brother is a very interesting piece of electro-magnetic mechanism, beautifully simple and practical. It is exhibited by the British and Irish Magnetic Telegraph Company, who it extensively on their lines, thereby saving considerable amount in working charges, as a separate clerk is not needed, as in other systems, to write down the words received by the manipulator. The arrangements are very simple. The current is set in motion by a pair of finger keys, one passing positive, the other negative currents, and so connected up, that the sender does not pass the current through his own receiving apparatus, but only to that of his correspondent, who is thus able to reply instantly on the sending key being released. Two small hammers attached to the armatures of two electro-magnetic coils, perform their office in obedience to the temporary magnetism induced at will in the soft iron cores of the latter. These hammers are thus wielded by the operator hundreds of miles away, and by means of preconcerted strokes on two bells of different tone, endow with mysterious life these "airy tongues that syllable men's names;" ringing marriage peals and knells of death, and identifying themselves with every phase of humanity.

Besides these instruments of every-day use, we must not omit to notice the marine-galvanometer of Professor W. Thomson, the use of which was so important in obtaining signals across the Atlantic. Its specialty, however, is for making delicate tests of long cables, especially at sea. Inside the coils, a small magnet fastened to a little circular mirror is strung on unspun silk fibre, passing through its centre of gravity. Outside the coils a strong directing magnet overpowers the force of the earth's magnetism. By this arrangement, neither that force nor the motion of the ship sensibly affect the position of the suspended magnet relatively to the coils. The deflections caused by currents through the coils are shown by a spot of light reflected from the mirror on to a graduated scale. This spot remains quite steady, no matter how much the ship pitches or rolls. Most accurate measurements of electric currents can thus be made at sea in all weathers.

Space does not permit us to do more than notice by name several other instruments which are well worthy of examination; such as the Morse type recorder of Messrs. Siemens, in the Prussian department; the States' Railway Society's system, without batteries at intermediate stations, in the Austrian department; and the telegraph of Mr. Lippens, in the Belgian Court. The railway electric signals of Edward Tyer, exhibited in Class 13, are also very beautiful apparatus, which merit the special attention of railway directors, managers, and shareholders, from their simplicity and certainty, as do also instruments for a similar purpose, exhibited by Mr. C. V. Walker, F.R.S.

We have now to notice, before concluding, a few of the apparatus purely electrical, in this department. Among these are two very interesting and scientific instruments, invented by Professor William Thomson, LL.D., of Glasgow, and exhibited in Class 13, by James White, of that city.

They are portable apparatus for observing atmospheric electricity, and have been recently introduced by Dr. Thomson into the observatory at Kew.

The first is an electrometer, with burning match collector. This instrument consists of a Leyden phial, in a stout protecting case of brass, having a separately insulated metal stage within it, which communicates by metal with an outer insulated rod. This rod bears a burning match about three feet above the head of the observer, who holds the instrument in one hand, steadying it with the aid of a shoulder strap. The interior metal stage bears a stretched platinum wire of very fine gauge, to the middle of which a light needle of aluminium is attached and accurately balanced, so as to exhibit no angular deflection in whatever position the instrument is held. This platinum wire may be turned at pleasure through any measured angle by means of a graduated circle which is carried round by a glass finger, attached to an uninsulated metal wheel, worked from the outside of the case by a tanget screw. Two metal plates attached to the insulated stage, and therefore in metallic communication with the needle, repel its ends when electrified. This is always the case when, by the communication of electricity, either to the inside coating of the Leyden phial, or to the insulated stage, these two metallic systems are brought to different electric potentials. The square root of the amount of torsion of the platinum wire measured by the number of divisions observed on the graduated circle when it is turned so as to bring the needle to a definite position, measures the difference of potentials between the two metallic systems.

In the regular use of the instrument, the Leyden phial is always kept charged with negative electricity. The outer conductor is made to take the same potential as the air at the point of the burning match, and the difference between this potential and that of the inner coating of the jar, is measured by the observer standing in the open air with the instrument in his hand, in the manner above described. The difference of the earth's potential from that of the inner coating of the jar is occasionally measured in the same way by disinsulating the outer conductor. The inner surface of the glass of the jar and the glass insulating bearing the inner stage, &c., are all kept very dry by means of pumice-stone, moistened by sulphuric acid in proper receptacles, so as to absorb all dampness from the air within the case. Thus the insulation is exceedingly good in all weathers, and the Leyden jar does not, when in good order, lose its charge so rapidly as one per cent. per day. This charge, however, can at any time be replenished by a single spark from a small electrophorus, adapted to give negative electricity, which accompanies the instrument.

Dr. Thomson's other electrometer is called a stationary water-dropping collector. The chief difference between this and the apparatus just described consists in substituting for the burning match a stout copper can, to which, when about to be used, is attached a pipe three or four feet long, having a fine nozzle at the end of it. The can is set on an insulating stand, and filled with water, which is allowed to flow out in drops at the nozzle. It is thus brought to the same electric potential as the air at the point where the stream from the nozzle breaks into drops. The air-potential thus obtained is measured by means of the electrometer, in the manner previously described. The principles of the two methods of collecting by fire and by water are explained in Nichol's "Cyclopedia," second edition (1859), under the head, "Electricity-atmospheric."

Mr. C. F. Varley also exhibits an interesting apparatus for testing the electrical state of the atmosphere when its power is too weak for ordinary instruments. It is called a multiplying electrometer, and consists of six discs of ebonite, carrying on them plates of metal. These plates rotate between insulated metal cheeks. On communicating a charge to one pair of the cheeks, the rotating plates when inside are charged by induction with electricity of the opposite kind, as the plate at that moment is put in contact with the earth. On this plate reaching the insulated cheeks on the other side, it touches them and communicates to them its charge; and thus by rotating the disc, electricity of the opposite kind is accumulated on the second cheeks without impairing the original charge. These cheeks are connected with other cheeks acted upon by the second plate, and these again act on the third, and so on throughout the six, which in this way, by converting mechanical force, through the instrumentality of induction, into electricity, multiply the charge to a tension of from 4,000 to 6,000 times in this machine; so that on making contact for one moment with a single cell of Daniell's battery at the one end, quarter-inch sparks appear at the other, of the same kind of electricity. On reversing the single cell of the battery at the one end, electricity at the other end is also changed.

The principle of this machine has been extended to the construction of electrical machines; but in this application the effects are produced by induction without any friction whatever.

Messrs. C. and S. A. Varley, and Messrs. Silver, also exhibit large ebonite electrical machines. That of Messrs. Varley is a particularly fine one. The disc is three feet in diameter, and is excited by a soft amalgam composed of zinc, tin, mercury, and lard. It was chiefly constructed after the design of Dr. Winter, of Vienna, and was shown some little time ago in the Theatre of the Royal Institution, where it was made to give out sparks of from 16 to 20 inches in length.

There are many other highly interesting electrical apparatus in the Exhibition, which want of space compels us to leave unnoticed. We must not, however, in gratitude to a great discoverer, omit to call the reader's attention to some voltaic piles and other electrical objects, exhibited by the University of Pavia, as having once belonged to the immortal Volta, and, therefore, possessing an interest peculiarly their own.

GAS ENGINEERING.—INTERNATIONAL EXHIBITION.

Nothing can be more instructive than to note the improvements that have been effected during the last decennial period in engineering and mechanics in their various departments. This week we will offer some observations on the manufacture and distribution of illuminating gas.

English chemists apply the word "retort" to all vessels used for the decomposition or distillization of materials by heat. In gas works, the coal is placed in large sealed tubes (retorts), heated to an orange colour by the fire of a furnace. The decomposition of coal by heat produces four gaseous binary compounds, also two highly volatile liquid binary compounds, and two vapours, forming tar and ammoniacal water, of the same binary character, the residuum left in the retort being the well-known gas coke. Only one out of the gaseous mixtures evolved is commercially valuable, namely, the carburetted hydrogen, commonly called coal gas. The rest of the gases and vapours are removed by the mechanical means of condensation, washing or scrubbing, and by the chemical action of lime, or a metallic oxyde.

At the present time there are about one thousand coal gas companies carrying on their operations in the United Kingdom, all of which have been formed since the beginning of the present century. Some of these companies, such as those at Hull, Liverpool, &c., were started with the object of supplying oil gas; but, after working unprofitably for many years, they all abandoned oil for coal.

The best illustration of the alteration effected since 1851 is the number of exhibitors of fire-clay gas retorts at the International Exhibition. This has been caused through iron gas retorts being superseded by earthenware retorts in almost every town exceeding ten thousand inhabitants. The slate clay from the coal series is employed in England by the celebrated makers of fire goods at Stourbridge, Wortley, Newcastle, &c. Clay for fire-brick work should contain no lime, magnesia, nor iron; when used for gas retorts, it is necessary to mix the clay with pounded fire brick, to prevent cracking during the process of baking or drying. Some retorts at the Exhibition have the smoothness of marble with the appearance of soap; such are made wholly from ground fire-clay—quite unfit for practical purposes. Other retorts are thickly covered over with bone ash, so that their general form alone can be distinguished.

Near the termination of the machinery department, Western Annex, are to be seen some very large pieces of fire-clay goods, exhibited by Monsieurs T. Boucher and A. Keller, of Belgium. We question whether any such goods of corresponding size have ever been made in England.

In Class 10 Messrs. Cowen show as well as they can in a corner two beautifully made gas retorts, manufactured from the Newcastle fire-clay. Here, also, Messrs. Ingham and Clift, of Wortley, have stalls; also Messrs. William Stephenson and Son. In order to see similar articles of other exhibitors, it is necessary to go to the covered and open courts, Class 1, Eastern Annex. The stand of Messrs. John Hall and Co., No. 134, contains a glass house pot of superior make, also gas retorts and crucibles, partly made from carbon incrustation. Messrs. George Ramsay, of Newcastle, and King Brothers, of Stourbridge, show large blocks of unburnt fire-clay. Near them is a little model of an ordinary setting, of seven fire-clay long retorts, exhibited by Mr. Addison Potter, with which visitors can compare the working setting of Walcott's patent gas retorts erected in an adjoining open court. It is stated the patent retorts can be made to last, without rebuilding, for ten or more years—the common mode requires to be built every two or three years. Engineers should see before forming an opinion of the respective merits of the two methods. No chemical analysis of any of the fire-clays exhibited is given; this omission should be rectified on the next occasion. The silica and alumina should exist in such proportions in fire-clay, as to ensure their being plastic and refractory.

The civil engineering department contains the beautiful coal gas apparatus invented and exhibited by Mr. Geo. Bower, for lighting isolated country mansions and factories. Nobody could conceive, without seeing this little gas making affair, occupying only a few square feet of space, that it would supply gas for twenty lights. Messrs. J. Porter and Co. show three coal gas apparatus; one of them, called the national gas apparatus, is an invention of Mr. George Bower, from whom the patent rights have been purchased. There is also a little gas apparatus shown by Mr. Edmundson, in Class 10. At the last Exhibition several modes were shown for making oil gas; now, not one is to be seen. One, however, was promised by Mr. J. E. Thompson, of Toronto, for manufacturing gas from rock oil, and described as a portable petroleum gas retort, with purifier and gas-holder. Where cost is any object, rock oil cannot compete with coal, as eighty gallons of oil, at one shilling per gallon, would yield about the same quantity of gas as a ton of coal. In gas-works situated where coals are of inferior quality, it might possibly be advantageous to have a tank of rock oil outside the retort house. Then a main pipe from the cistern, with branch connections to each of the clay or iron coal-gas retorts, would permit a jet of oil to be injected over the heated coke in the retorts to increase the illuminating power of the gas produced during the latter part of a charge.

At the Exhibition of 1851, there was shown an unpatented meter, by Mr. R. C. Mead, the principle of which consisted in replenishing from a surplus reservoir, by an arm dipping into it on each revolution of the axle, the water absorbed by the dry gas. Since then a very large number of patents have been taken out to do the same thing, with slight modifications.

In Class 31, B, No. 6,283, there can be seen the last practical ideas of the comparatively obscure man to whom the world is indebted, through his inventions, for the development of gas manufacture. The discoveries of the late Mr. Samuel Clegg consisted principally in a cheap mode of purifying gas—in the gas meter—the governor, which is as useful as Watt's steam engine governor, and the hydraulic mains, which enable any number of gas retorts to be worked at one time without leakage. This engineer, styled the father of gas-lighting, died about two years since in poverty, leaving his wife in pecuniary distress. Surely she has a claim on the Government. Messrs. Bischoff and Co. are the exhibitors of Clegg's gas meter. It is an improvement on the wet meter, ensuring correct registrations independent of a variation of the water level, whether caused by evaporation or wilful abstraction. The principle consists in floating the drum by an air vessel, which permits the revolving drum to rise or fall according to the height of the water in the case, and to work free from friction on the bearings, In this compartment is Mr. Richards's stall, No. 6,342, which shows the make of the first gas dry meter, as manufactured by the Dry Meter Company in 1835-6. The cylinder, or case of this meter, is divided by a loose piece of leather, acting as a diaphragm, its use being to separate the measured from the unmeasured gas. The measured gas is expelled from one side of the leather by the entrance of the unmeasured gas, which distends the leather from the opposite side. When the leather is distended to its limits, the valve changes, and indicates at the same time. The reverse action then occurs, and the gas in the filled compartment is expelled by the gas entering the empty compartment. This is the principle of all dry meters. The Dry Meter Company ceased to exist, after losing nearly £100,000. The first successful dry meter is that patented by N. Defries and N F. Taylor, in 1843. Mr. Richards likewise exhibits his own gas dry meter, and one invented by him in 1844. The description of meter here shown is that made by many of the dry meter manufacturers in the United Kingdom, the production annually being nearly 80,000.

Changing to Class 13, Mr. Sugg's case contains a photometer, eudiometer, exhauster gauge, &c. The photometer was invented by Count Rumford for comparing the light of candles and gas by their respective shadows in a black-lined box, excepting the end on which the light is compared, and that is painted white. The late Baron Bunsen also invented a photometer, consisting of the principle of comparing transmitted and reflected light on a transparent disc, with an opaque centre, placed between two lights. When the disc becomes of a uniform appearance, the difference of the squares of the distances of the lights from the shade will give their values. The patent photometer exhibited combines both these inventions. The eudiometer is a glass tube for testing gas by means of bromine, sulphate of copper, and caustic potash, of its volumes of hydro-carbon vapours, sulphuretted hydrogen, and carbonic acid. The exhauster gauge is a small tin case, with a centre tube; when pressure exists on the retorts, the water is forced up the tube; when a vacuum is caused, the water is drawn down. The rising or falling of the water in the tube is shown by the action of a float transmitted to a dial.

The correct measurement of gas meters is now secured by the "Sales of Gas Act." In some parts of the country gas meters have been corrected to so much nicety, that the slamming of a door will cause the water float valve in the meter to fall, and the lights to go out. The Act referred to limits the range of error in gas meters to 2 per cent. as against the consumer, and 3 per cent. as against the gas manufacturer. Mr. G. Glover, of Pimlico, provided an instrument whereby the intentions of the legislature can be carried out. The Exhibition contains many objects of more dazzling beauty, but few, if any, having a higher finish, or will serve a purpose of greater public utility than this. Messrs. G. Glover also exhibit a meter, by which quantities of gas so minute as from [illegible] to [illegible] part of a cubic foot can be measured with precision each second.

The various oxides of iron have long been in use for purifying coal gas. Mr. Warner advertizes his patent anhydrous oxide of iron; Mr. Cockey shews his patent centre valve, which will perform the work of half a dozen single valves. The pressure and supply of gas to the Exhibition Building is governed by the regulating valves of Messrs. C. Walker and Son's make, Class 10. Their stall contains the ordinary rack and pinion valves, in order to illustrate more clearly their improved protective screw and index valve.

A sample of the red tin canisters which uselessly disfigure the public lamps can be seen at the Exhibition. Also Mr. Prossex's oxy-hydrogen lime lamp, the identical one used for three months at the South Foreland lighthouse. The lime light was fitted up two years since at Westminster Bridge. The great cost of manufacturing oxygen gas, together with this mode requiring two lines of pipe, caused its discontinuance. Mr. Clarke shows his patent gas regulator, which, like those invented by Mr. Paddon and Mr. Hart, are useful for public lamps. There is also Mr. R. H Hughes's safety whistling gas chandelier hung up in Class 31. In a similar manner whistles might be fixed a few inches above the lower curbs of gasholders, to make known when they are full. There are to be seen gasaliers by Messrs. Hart and Son, Messrs. Mapplebeck and Lowe, Messrs. Lambert and Son, and Messrs. Hardman and Son. The gas standards of Messrs. Johnson Brothers, are mediæval, inlaid with various coloured crystals; so, also, are Mr. Skidmore's two standards for Lichfield cathedral.

Though it is probable that steam engine exhausters will soon be universally used in gas works, where the make equals five millions annually, there is not one shown at the Exhibition. Class 10 contains some bituminized pipes for gas and water purposes. Time alone will satisfy people whether such description of pipes will retain water under pressure, or bear the chemical action of gas. There are some large-sized cast-iron pipes exhibited by Messrs, Cochrane, of Dudley, Class 1, and by Mr. D. Y. Stewart, and Mr. Edington, of Glasgow, Class 10.

In 1851 the only paraffine candle exhibited was made from turf. The considerable display made by Mr. Young, Class 2, and Messrs. Field, Class 6, and many others, of blocks of paraffine and candles, prove a considerable manufacture of this article has arisen during the past ten years. In 1871 it is probable that the paraffine exhibited will be made from the lately introduced rock oil. The many dazzling colours now so universally admired, extracted from coal tar—on view in Class 2, No. 600, &c.—effectually remove any doubt respecting the future splendour of British dyes; they may be equalled, but not surpassed. In Class 8 there is Mr. Shepard's magneto-electric light to be seen, also Mr. Holmes's. This remarkable light has been two winters in use at the South Foreland lighthouse, and is now fitted up by the Trinity Board at Dungeness. The light produced is intense—sufficient, it is stated, in a revolving lens giving off six rays, to enable any person with average sight to read at a distance of ten miles.

Who can inform us what becomes of natural and artificial light and heat? The late George Stephenson suggested that the coal formations absorbed from the sun in past ages the heat that produces steam power, and illuminates our streets at night. To substantiate this notion, some matter should now be absorbing the sun's rays, &c. There is one agent, oxygen, which is daily removed from the atmosphere by its action on rocks and metals. May not, therefore, the sun's rays preserve oxygen in equilibrium? GEORGE WALCOTT, C.E.

FRENCH EXPEDITION TO MEXICO.

A NATIONAL crime is now being perpetrated by France in Mexico, by the seeming consent of Europe. A triple alliance was formed between England, France, and Spain, so that a pressure should be brought to bear on the Mexican Government, to redeem certain bonds, and redress certain grievances which Europeans had suffered from the hands of the Mexicans. It soon turned out that this joint expedition could not co-operate harmoniously. The governments of England and Spain, from some motives not yet explained, held back and left the French forces to fight the Mexicans single-handed. Those forces having been repulsed, they are about to be considerably augmented. What does all this mean? Why should France, in its attempt to force a monarchical or any other government on Mexico against the will of the Mexicans, have the silent consent of the British Cabinet, and the subdued approbation of the *Times*? Why should non-intervention, so ably advocated by our Government in European affairs, and so consistently carried out in our transactions with the United States, be so quietly ignored in relation to Mexican matters? Would France have attempted to carry out this game in Mexico were not the United States at war amongst themselves? Is not this interference in American affairs by European Governments a dangerous precedent? Is England to be a silent looker-on when international relationships are trampled under foot? Our province is science, not politics, or we should not content ourselves by asking questions.

THE MENANGLE VIADUCT, AUSTRALIA.

On the Great Southern Extension Railway of Australia much progress is being made; but at present the greatest amount of labour is being concentrated on the viaduct intended to span the river Nepean, at Menangle. This, indeed, is by far the most extensive work of the kind as yet undertaken in the colony. Its immense size can scarcely be realized from a mere statement of its dimensions, and the vast size and height of the piers excite at once surprise and admiration. The altitude and violence of the stream, after heavy rains, made it a matter of necessity that the piers of the viaduct should be calculated to resist the pressure they would occasionally have to withstand, and that they should be carried to such a height as to leave the superstructure above th extreme flood level. The floor of the viaduct will accordingly be six feet higher than the highest water mark, which is fifty-six feet above the river's bed. The principal supports of the viaduct consist of four stone piers, placed at a distance of a hundred and fifty feet from each other. Each pier is oval in shape. The two centre piers are eighty feet by twenty at the base, tapering upwards to fifty-two feet by twelve at the top. Some idea may be formed of the enormous amount of labour involved in carrying out this work when it is stated that, in order to obtain foundations for the two central piers, coffer dams had to be constructed, and all the water pumped out. Upon the removal of the water from the coffer dam of the second pier, a solid base was soon found; but within the enclosure of the third pier the operations were less satisfactory, the bed of the rock having been found to be sunk at one end, thus requiring the removal of a great quantity of sand and mud, and a descent to a much greater depth than was anticipated, for a foundation. The fourth pier will not rest upon the rock, but upon a timber platform, which will be fixed upon parallel rows of bearing and sheathing piles. The former will be driven down to the rock, at a depth of from forty-five to sixty feet below the level of the platform, their use being to confine the sand around the piles. On the top of the bearing piles there are to be sills, both longitudinal and transverse, and on these two layers of diagonal planking, four inches in thickness. Above these the masonry will be set. The quarry which supplies the stone for the piers is about a mile and quarter from the site of the viaduct, and higher up the river. A tramway connects the quarry with the northern approach to the bridge. This is made on an easy incline, thus allowing the trucks to run down without traction. Rails are also laid down the incline to a temporary staging across the river. By means of an endless rope, the descent of the loaded trucks on one line exerts the power to bring up the empty trucks on the other. The blocks of stone are cut in sixteen-inch courses, and after being sent down, are hoisted into their places by means of shears. Between the first and second piers three or four bays of staging are being put up, to support a temporary superstructure, on which to place and put together the iron plates, which are on their way from Peto and Co.'s establishment, Birkenhead. The plates are in lengths of forty feet, and, on being attached, will form two parallel solid girders. Upon these there will be iron girders, three feet apart; and above all will be the planking, which will be similar to that of ordinary railway bridges, with the exception that it will be close jointed. There will be a clear roadway of twenty-four feet. The eastern side will be devoted to the railway, leaving a sufficient width for ordinary carriage traffic, should it be found desirable to combine that accommodation. In addition to the portion of the viaduct within the four piers—the length of which will be five hundred feet—two lengthy viaducts have to be constructed at either end, for the approaches to the structure. The viaduct on the northern side will be 980 feet in length, with twenty-six feet opening, the length of the piles varying from eight to nineteen feet. This part of the work is almost finished. On the southern side, the viaduct will be 440 feet in length, with twenty-five feet openings. With regard to the general progress made with the work, the first, or northernmost, pier is finished; the second is more than half finished; the foundations are being laid for the third pier, and for the fourth a large number of the piles have been driven. The works, as has been said, are being pushed on with the greatest activity. One hundred and thirty quarrymen are engaged, with some fifty masons, and these are working day and night. At the present rate of progress, the masonry will be completed by the month of July next; but it is scarcely possible for the iron work to arrive by that time. The loss of the Indian Ocean, indeed, will retard the work; for a large quantity of the iron-work was unfortunately lost with that ship.

Another portion of the iron-work was shipped on board the Oaklands, which vessel has probably arrived before this.

THE TASMANIAN COURT OF THE INTERNATIONAL EXHIBITION.

In the central avenue of the International Exhibiton, is a court devoted to the products, collected by a local commission, of Tasmania. A large trophy of timber exhibits the variety of the wood found in that colony. This timber is recommended for its durability, and the low price at which it can be supplied, and for its suitability to shipbuilders and railway contractors, &c.

By the estimate of the late Robert Stephenson (1854), 2,800,000 railway sleepers required renewing every year, out of the 36 millions of sleepers in use in Great Britain. A blue gum, or stringy bark, or gum-topped stringy bark, or peppermint wood sleeper, as exhibited in this trophy, would, under the most trying circumstances, last from fifteen to twenty years, and under ordinary or favourable circumstances, might last three times that period. The sleepers now in use require renewing, according to Mr. Stephenson, every twelve or fourteen years. It is estimated that this quantity requires the wood of 7,000 acres of English forest land annually, whilst better woods are growing in the wild land of Tasmania as common as weeds.

Of ornamental woods the trophy furnishes a great variety suited for cabinet work. The myrtle tree (so called) of which Tasmania contains immense forests, from its richness of tint and varied venation is well suited for this purpose. Other woods, as blackwood, muskwood, Huon pine, dogwood, sassafras, pinkwood, native laurel, she-oak, &c., offer a variety of selection in tint and figure, in which the ingenious cabinet-maker will find ample scope for tasteful innovation. The superiority of Tasmanian woods, particularly the blue gum, having thus been carefully demonstrated by experiment, and amply corroborated by the experience of their durability, it remains to be determined whether they can be supplied of the large size, and shapes required—say for shipbuilding. The structure of the trophy, which is mostly formed of ordinary market timber, or of such sample timber as can be supplied in almost any quantity will afford an answer to this question.

The metalliferous collection comprises gold, which exists in greater or less quantities in various parts of this colony. The iron ores possess great richness, and it is believed will be very profitably worked.

A valuable collection of coal has been made by Mr. C. Gould, the Government geologist. The main portion of the fuel used in Hobart Town is derived from mines at New Town, in the close vicinity of the capital, and from Tasman's Peninsula; but it is generally believed that coal beds of far greater value than those which have been worked, principally on account of their easy accessibility, exist in other parts of the island. The series of specimens from Mount Nicholas will illustrate the coal bed to which public attention has recently been most particularly directed. The seam of coal which crops out at various points on the side of Mount Nicholas, locally known as the Killymoon seam, overhanging Break o' Day plains, at a height of about 500 feet—can be worked at an adit level, is distant nine miles from the Port of Falmouth, is highly bituminous, and it is believed is well suited for steam, gas, and domestic puposes. The same seam crops out near Fingal and at various other parts, but the main seam is that now illustrated by samples from different portions of it. This coal bed is estimated to occupy an area of about 14 miles, on the northern side of the Break o' Day plains. Various other portions of the bed are equally accessible, but although they are mostly bituminous, they are inferior in thickness to the Killymoon seam. Bituminous coal samples are also furnished from the coal bed of the Douglas River and from Long Point, both on the east coast. The coal from both these districts is good, and the coal bed from which they are taken is said to extend over an area of about fiteen miles, and the seam at the Douglas River to be above eight feet thick. At Long Point it is 6 feet 10 inches thick, very bituminous, and within an easy distance of the shipping place. This coal is rapidly rising in public estimation, and a company has just been formed to work it. Beds in the Mersey River have also been found, and although limited in quantity, have been profitably worked, as they are easy of access. The coal is very bituminous, is used by the coasting steamers and in Launceston, and has been recently exported to Victoria.

The bituminous coal from Hamilton is said to be very good. It lies about 40 feet deep, in a seam 4ft. 6in. thick, and has been used, and favourably reported on, by the Derwent steamers, from the shipping place of which, at New Norfolk, it is about 20 miles distant.

The anthracite coal is abundant on the southern side of the island, and specimens are exhibited from New Town, Tasman's Peninsula, Adventure Bay (Bruni Island), Three Hut Point in D'Entrecasteaux Channel. Four collieries are represented in the specimens from New Town, near Hobart Town. The coal at Tasman's Peninsula has been worked for 25 years and largely used in Hobart Town. The seam is from 3 ft. 6 in. to 4 ft. 6 in. thick, is worked by a shaft 25 yards deep, and within about 100 yards of the water's edge.

The coal formation on the south side of the island extends round the mouth of the Huon to S. W. Cape, within which range many deposits have been discovered. With a supply so varied and extensive, some localities will probably be soon found to possess coal of first rate character, easy of access. Private capital is seldom sufficiently in excess in the colonies to admit of its being relied on as the source of development of the mineral wealth which Tasmania doubtless possesses. The matter is one of national as well as colonial importance, now that steam vessels may be expected to take a very prominent part in any future maritime war, and the attention of the colonial government has of late been specially directed to it. The labours of Mr. Gould, the government geologist, have been almost concentrated on this matter recently, the Parliament have voted a sum of money for its investigation, and a commission was gazetted in March, to take charge of experiments on and the selection of some of the best specimens, easily and abundantly procurable, to be tested in bulk, by the Admiralty authorities in England.

TRIAL OF THE FIRE ENGINES EXHIBITED IN THE INTERNATIONAL EXHIBITION.

On Tuesday morning, at eight o'Clock, the Fire Engines from the Exhibition were put under trial at the Serpentine in Hyde Park, previous to adjudication on their relative merits. Among those officially engaged were His Grace the Duke of Sutherland, Lord Claud Hamilton, Professor Rankine, of the Glasgow University, Mr. James E. McConnell C.E., Sir Wentworth Dilke, Mr. Zerah Colburn C. E., Mr. Wellington Lee, of New York, Mr. Charles B. King, M.E., Mr. Frederick Hodges, Mr. Stephen English, Captain Shaw, L.F.E., Captain Bent and Captain Fowke, Mr. Hewett, of Liverpool, Mr. C. White, of the County Fire Office, Mr. M. Browne, of the Westminster Fire Office, Mr. E. S. Beddome, of Lloyd's, Mr. Peek, from Amsterdam, Messrs. Merryweather and Son, Messrs. Shand and Mason, Mr. Roberts, of Millwall, Mr. Rose, of Manchester, Messrs. Baddeley, Spencer, and Gordon, and representatives of the Coventry, West Ham, Notting Hill, Manchester, Kingsland, Hackney, and indeed from most of the fire-brigades in the kingdom.

The first experiment commenced with a trial of Messrs. Shand and Mason's, Messrs. Merryweather and Son's, and one built by Mr. Rose, of Manchester. The result proved in favour of Messrs. Shand and Mason, 1; Merryweather and Son, 2; Rose, 3. Three other experiments were made with the same results, the engines throwing respectively in 30 seconds 78, 68, and 65 gallons. Taking the trials of the larger engines at a greater distance, Shand and Mason's engine threw 324 gallons, and Merryweather's 323 gallons in the minute. Another trial between Shand and Mason's and Merryweather's engines was declared as follows:—The first named, with a 36 inch stroke, delivered 190 gallons; the second named, with a 29 inch stroke, 178 gallons per minute.

The testimonial engine presented to Mr. Frederick Hodges was next tried against Shand and Mason's, and one built by Messrs. Merryweather and Son, when the result proved in favour of Hodges' engine by a long way (we may here add that Merryweather and Son have in this engine embodied a portion of their recent patent for fire-engine and other pumps); the steadiness of its jet and great volume of water astonished all present.

During the day several important trials were made with Merryweather's, Roberts', and Captain Fowke's engine. Several smaller engines manufactured by Messrs. Warner and Sons, Blackhorn and Co. (of Spalding), and several foreign manufacturers, were exhibited, which were of such indifferent workmanship that it was not to be expected other than that they should break down; Messrs. Warner's engine, however, having before its mishap performed some very creditable work.

The engines of Messrs. Shand and Mason and Messrs. Merryweather and Son were pronounced by the jurors to be the best manufactured and most effectual in their results.

The banks of the Serpentine were thronged to excess during the whole day, but the greatest order was maintained. The Prince of Wales, the Princess Alice, and the younger members of the Royal family passed over the Serpentine bridge, and witnessed from their carriages the operations of the engines. The steam fire engines are reserved for trial until a subsequent day.

GIFFARD'S BOILERS AND ENGINES.

This invention of improvements in steam engines and boilers, patented by Mr. H. Giffard, of Paris, consists in the construction of boilers and engines for the employment of steam at very high pressures, at least five times that of ordinary boilers. For this purpose a boiler is constructed with a reservoir or reservoirs for containing steam and water at about the same temperature, constituting a reserve of heat and motive power, and intended to keep the pressure of the steam up and the work of the engine regular, notwithstanding the diminution of pressure and irregularities consequent on the incidents of feed and combustion, and the power expended. Arrangements are made for working steam expansively at very high pressures.

In one arrangement the boiler is constructed with a reservoir, consisting of a chamber containing hot water and steam, and placed either outside of, or wholly or partially enclosed in the furnace, into which chamber opens a set of tubes for holding water and steam, and set one above another in a more or less inclined position over the fire-bars, as indicated at Fig. 1. The tubes communicate with the reservoir at one end, and their other ends lead to outside the furnace, where they are closed or plugged. (Waste heat may be utilized by sending feed water into the upper tubes, or circulating it through a serpentine, or otherwise in the chimney.) A number of such reservoirs and tubes may be arranged side by side communicating above and below, and may form rows of horizontal and vertical tubes. Branch tubes may open into the tubes transversely, leading from them to outside the furnace, where the ends are plugged. Sometimes the tubes are dispensed with, and only the reservoir used. The reservoirs are sometimes composed of tubes of a spiral or other arrangement, of sufficient capacity to contain water and steam enough to keep the engine going a certain time, though feed and fire should be stopped; and sometimes the tubes may be vertical, the flames and hot gases passing through them to the

GIFFARD'S BOILERS AND ENGINES.

FIG. 1.

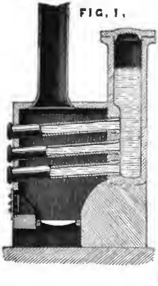


FIG. 2.

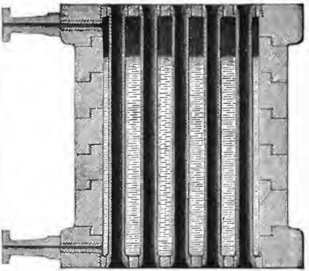
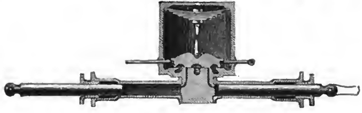


FIG. 3.



chimney; the upper parts dry or superheat the steam that surrounds them.

Another arrangement is a horizontal or inclined tubular boiler, in which a single shell contains tubes, stays, and reserveir, or two sheils of smaller diameter, of which one that contains the reserveir is set over and communicates with the other in which are the tubes.

In one arrangement the boiler ends are of thick iron, screwed and rivetted at each end, the tubes acting as stays between them, and the shell is strengthened by hoops. The furnace need not be enclosed in the boiler, but may be outside, and joined on to it. The appendages, such as safety valve, gauge cocks, and delivery pipes, are very small.

In another arrangement a tubular boiler is constructed of a number of rings or annular pieces turned, screwed, "caulked," and connected together at half thickness, as illustrated in Fig. 2. The cocks are screwed into the two end rings, which are made thicker than the others. The boiler ends are composed of steel or other plates screwed into the end rings, and having the tubes screwed and rivetted or fixed into them.

Fig. 3 is a vertical section of the improved steam engine. A pair of tubes or narrow cylinders, closed at one end by a block M, and terminating at the opposite ends by stuffing boxes. Ports or ways are formed through the block, for the passage of steam to and from the cylinders. P is the steam inlet way. Q Q, the eduction ways for the escape of the steam after acting in the tubes. A slide valve enclosed in a box is worked to and fro on the face of the block, opening and closing the ports; a spring pressing on a sort of double rod adjusted as to length by a screw, one end of the rod resting on the valve, by these means the tendency of the valve to rise may be duly balanced The plungers are of such length and diameter as to fill the whole area of the tube when inserted. The plungers work through the stuffing boxes and are connected together by links or side rods.

ROYAL INSTITUTION OF GREAT BRITAIN

(Concluded from page 397.)

Changes in Progress.—Having directed attention to the strength of ships, and the necessity for their improved construction, we may now advert to the changes by which we are surrounded and to the revolution now pending over the destinies of the navy, and the deadly weapons now forging for its destruction. It is not for us alone, but for all other maritime nations, that these Cyclopean monsters are now issuing from the furnaces of Vulcan; and it behoves all those exposed to such merciless enemies to be upon their guard, and to have their Warriors, Merrimacs, and Monitors ever ready, clothed in mail from stem to stern, to encounter such formidable foes. It has been seen, and every experiment exemplifies the same fact, that the iron ship with its coat of armour is a totally different construction to that of the wooden walls which for centuries have been the pride and glory of the country. Three-deckers, like the Victory and the Ville de Paris of the last century, would not exist an hour against the sea monsters now coming into use.

The days of our wooden walls are therefore gone; and instead of the gallant bearing of a 100-gun ship, with every inch of canvas set, dashing the spray from her bows and careering merrily over the ocean, we shall find in its place a black demon, some five or six hundred feet long, stealing along with a black funnel and flag-staff on her mission of destruction and scarcely seen above water, excepting only to show a row of teeth on each side, as formidable as the immense iron carcass that is floating below. This may, with our present impressions, be considered a perspective of the future navy of England,—probably not encouraging, —but one on which the security of the country may ultimately have to depend, and to the construction of which the whole power and skill of the nation should be directed. I have noticed these changes, which are fast approaching, from the conviction that the progress of the applied sciences is not only revolutionizing our habits in the development of naval constructions, as in every other branch of industry, but the art of war is undergoing the same changes as those which have done so much for the industrial resources of the country in times of peace. It is therefore necessary to prepare for the changes now in progress, and endeavour to effect them on principles calculated, not only to ensure security, but to place this country at the head of constructive art. It is to attain these objects that a long and laborious class of experiments have been undertaken by the Government, to determine how the future navy of England shall be built; how it should be armed; and under what conditions it can best maintain the supremacy of the seas. This question does not exclusively confine itself to armour-plated vessels, but also to the construction of ships which, in every case, should be strong and powerful enough to contend against either winds and waves, or to battle with the enemy. It is for these reasons that I have ventured to direct attention to the strength of vessels, and to show that some of our mercantile ships are exceedingly weak, arising probably from causes of a mistaken economy on the one hand, or a deficiency of knowledge or neglect of first principles on the other.

Now it is evident that our future ships of war of the first class must be long and shallow; moreover, they must contain elements of strength and powers of resistance that do not enter into the construction of vessels that are shorter and nearly double the depth. If we take a first rate ship of the present construction, such as the Duke of Wellington, and compare it with one of the new or forthcoming construction, carrying the same weight of ordnance, we should require a vessel nearly twice the length and little more than half her depth. Let us, for example, suppose the Duke of Wellington to be 360 feet long and 60 feet deep, and the new construction 500 feet long and 46 feet deep; we should then have for the resistance of the Duke of Wellington to a tranverse strain tending to break her back,

$$W = \frac{a\,d\,c}{l}$$

Taking 60 as the constant, and the area of the bottom and upper deck as 1060 square inches, we have

$$W = \frac{1060 \times 60 \times 60}{349} = 12{,}223 \text{ tons,}$$

as the weight that would break her in the middle. Let us now take the new ship, and give her the same area top and bottom, and again we have

$$W = \frac{1060 \times 46 \times 60}{500} = 5851 \text{ tons,}$$

which is less than half the strength. From this it is obvious—if we are correct in our calculations—that he utmost care and attention is requisite in design and construction to ensure stability and perfect security in the build of ships.

Mechanical Properties of Iron.—It is unnecessary to give more examples in regard to strength, and the proportions that should be observed in the construction of our future navy. I have simply directed attention to it as a subject of great importance, and one that I am satisfied will receive careful consideration on the part of the Admiralty and the Comptroller of the Navy.

The next question for consideration is, the properties of iron best calculated to resist the penetration of shot at high velocities, and in this I am fortunate in having before me the experiments of the Committee on Iron Plates, which may be enumerated as under:—

Specific Gravity.	Tensile Strength in Tons per Square Inch.	Compression per Unit of Length in Tons.	Statical Resistance to Punching in Tons; 1-inch Plate.
7·7621	24·802	14·203	40·1804

Remarks.—The specimens subjected to compression gradually squeezed down to one-half their original height, increasing at the same time in diameter till they attained 90 tons on the square inch.

In these experiments, four descriptions of iron were selected, marked A, B, C, D: the two first and last were taken from rolled and hammered iron plates, excepting C, which was homogeneous, and gave higher results to tension and dead pressure than the others.

In density and tenacity they stood as follows:—

Mark on Plates.	Density.	Tenacity in Tons.	Remarks
A Plates	7·8083	24·641	
B Plates	7·7035	23·351	
C Plates, homogeneous	7·9042	27·032	
D Plates	7·6322	24·171	

Here it will be observed, that the strengths are in the ratio of the densities, excepting only the B plates, which deviate from that law.

On the resistance to compression, it will be seen that in none of the experiments was the specimen actually crushed; but they evidently gave way at a pressure of 13 to 14 tons per square inch, and were considerably cracked and reduced in height by increased pressure.

From the experiments on punching, we derive the resistance of A, B, C, D plates to a flat-ended instrument forced through the plate by dead pressure, as follows:—

Mark on Plates.	Shearing Strain in Tons per Square Inch.	Ratio, taking A as Unity.
A Plates	18·511	1·000
B Plates	17·719	0·907
C Plates	21·561	1·163
D Plates	17·035	0·873

Here may be noticed, that the difference between the steel plates of series C, and the iron plates of series A, is not considerable, though in all the others the steel plates exhibit a superiority in statical resistance.

Having ascertained, by direct experiment, the mechanical resistance of different kinds of iron and steel plates to forces tending to rupture, it is interesting to observe the close relation which exists between not only the chemical analysis as obtained by Dr. Percy, but how nearly they approximate to the force of impact, as exhibited in the experiments with ordnance at Shoeburyness.

Dr. Percy, in his analysis, observes, that of all the plates tested at Shoeburyness, none have been found to resist better than those lettered A, B, C, D, with the exception of C. The iron of plate E contained less phosphorus than either of the three, A, B, D; and it is clearly established that phosphorus is an impurity which tends in a remarkable degree to render the metal "cold short," *i. e.*, brittle when cold.

The following table shows the chemical composition of these irons:—

Mark.	Carbon.	Sulphur	Phosphorus.	Silicon.	Manganese.
A	0·01636	0·104	0·186	0·125	0·25
B	0·03272	0·131	0·173	0·160	0·020
C	0·023	0·129	0·020	0·014	0·110
D	0·0436	0·115	0·328	0·174	0·250
E	0·170	0·0577	0·0594	0·110	0·330

Comparing the chemical analysis with the mechanical properties of the irons experimented upon, we find that the presence of 0·23 per cent. of carbon causes brittleness in the iron; and this was found to be the case in the homogeneous plates marked C; and although it was found equal to A plates in its resistance to tension and compression, it was very inferior to the others in resisting concussion or the force of impact. It therefore follows, that toughness combined with tenacity is the description of iron plate best adapted to resist shot at high velocities. It is also found that wrought-iron, which exhibits a fibrous fracture when broken by bending, presents a widely different aspect when suddenly snapped asunder by vibration, or by a sharp blow from a shot. In the former place the fibre is elongated by bending, and becomes developed in the shape of threads as fine as silk, whilst in the latter the fibres are broken short, and exhibit a decidedly crystalline fracture. But, in fact, every description of iron is crystalline in the first instance; and these crystals, by every succeeding process of hammering, rolling, &c., become elongated, and resolve themselves into fibres. There is, therefore, a wide difference in the appearance of the fracture of iron when broken by tearing and bending, and when broken by impact, where time is not an element in the force producing rupture.

If we examine with ordinary care the state of our iron manufacture as it existed half-a-century ago, we shall find that our knowledge of its properties was of a very crude and most imperfect character. We have yet much to learn, but the necessities arising from our position as a nation and the changes by which we are surrounded, will stimulate our exertions to the acquisition of knowledge and the application of science to a more extended investigation of a material destined, in course of time, to become the bulwark of the nation. It is, therefore, of primary importance, that we should make ourselves thoroughly acquainted, not only with the mechanical and chemical properties of iron, but we should moreover be able to apply it in such forms and conditions as are best calculated to meet the requirements of the age in which we live.

Entertaining these views, I cheerfully commenced with my talented colleagues the laborious investigations in which we are now engaged, and looking at the results of the recent experiment with the 300-pounder gun on the one hand, and the resisting targets on the other, there is every prospect of an arduous and long-continued contest.

From the Manchester experiments, to which I have alluded, we find that with plates of different thicknesses, the resistance varies directly as the thickness, that is, if the thickness be as the numbers 1, 2, 3, &c., the resistance will be as 1, 2, 3, &c.; but those obtained by impact at Shoeburyness show, that up to a certain thickness of plate, the resistance to projectiles increases nearly as the square of the thickness. That is, if the thickness be as the numbers 1, 2, 3, 4, &c., the resistance will be as the numbers 1, 4, 9, 16, &c. respectively. The measure therefore of the absolute destructive power of shot is its *vis viva*, not its momentum, as has been sometimes supposed, but the work accumulated in it varies directly as the weight of the shot multiplied into the square of the velocity.

There is therefore a great difference between statical pressure and dynamical effect: and in order to ascertain the difference between flatended and roundended shot, a series of experiments were undertaken with an instrument or punch exactly similar in size and diameter and precisely corresponding with the steel shot of the wall piece ·85 diameter employed in the experiments at Shoeburyness. The results on the A, B, C, and D plates are as follows:

Character of Plates.		Resistance in lbs.	
		Punch Flat-ended.	Punch Round-ended.
Half-inch thick	A Plates ...	57,936	61,886
	B Plates ...	57,060	48,788
	C Plates ...	71,035	65,324
	D Plates ...	49,060	43,337
Three-quarter-inch thick ...	B Plates ...	81,587	98,420
	D Plates ...	82,381	98,571
	Mean.........	67,017	72,754

These figures show that the statical resistance to punching is about the same whether the punch be flat-ended or round-ended, the mean being in the ratio of 1000 : 1085, or 8½ per cent. greater in the round-ended punch. It is, however, widely different when we consider the depth of indentation of the flat-ended punch, and compare it with that produced by the round-ended one, which is 3½ times greater. Hence, we derive this remarkable deduction, that whilst the statical resistance of plates to punching is nearly the same, whatever may be the form of the punch, yet the dynamic resistance or work done in punching is twice as great with a round-ended punch as with a flat-ended one. This, of course, only approximately expresses the true law; but it exhibits a remarkable coincidence with the results obtained by ordnance at Shoeburyness, and explains the difference which has been observed in these experiments, more particularly in those instances where round shot was discharged from smooth-bored guns at high velocities. To show more clearly the dynamic effect or work done by the weight of shot which struck some of the targets at different velocities, the following results have been obtained.

Target.	Weight of Shot striking Target; lbs.	Work done on Target.	
		Total Foot lbs.	Per Sq. Ft. Foot lbs.
Thorneycroft 8-inch Shield...	1253	—	28,078,000
Thorneycroft 10-inch Embrasure	1311	—	37,140,000
Roberts's Target............	946	822,000	19,720,000
Fairbairn's Target............	1024	324,000	28,311,000
Warrior Target	2229	312,000	62,570,000
The Committee's Target	6110	—	124,098,780

From the above, it will be observed, that the two last targets have sustained in work done what would, if concentrated, be sufficient to sink the largest vessel in the British navy.

We are all acquainted with the appearances and physical character of artillery, but few are conversant with the nature of the operations and the effects produced by shot on the sides of a ship or on resisting forts and targets.

The shot of a gun—to use the expression of my colleague, Mr. Pole—is simply the means of transferring mechanical power from one place to another. The gunpowder in the gun developes by its combustion a certain quantity of mechanical force, or work, as it is now called, and the object of the shot is to convey this work to a distance, and apply it to an object supposed to be otherwise inaccessible. The effect of this, according to Mr. Pole's formula, is—

W = weight of the shot in lbs.

V = its velocity in feet per second.

Then, by the principle of *vis viva*, the quantity of work stored up by the moving mass, measured in lbs one foot high, is—

$$= \frac{W V^2}{2 g}$$

g being the force of gravity = 32¼.

Thus, if we have a shot, like that recently used against the Warrior target, 156 lbs., moving at the rate of 1700 feet per second, the work done will be—

$$= \frac{156 \times (1700)^2}{64\frac{1}{2}} = 7{,}008{,}238 \text{ one foot high.}$$

Showing at once the immense power that this small body is able to deliver on every resisting medium tending to arrest its course, and bring its particles to a state of rest. Or, in other words, it is equivalent to raising upwards of 3,000 tons a foot high in the air.

The Application of Iron for Purposes of Defence.—Having examined in a very condensed and cursory manner the present state of our knowledge in regard to iron, and its application to the purposes of shipbuilding, let us now consider in what form and under what circumstances it can best be applied for the security of our vessels and forts. To the latter the answer is, Make the battery shields thick enough; but a very different solution is required for the navy, where the weight and thickness of the plates is limited to the carrying powers of the ship. It has been observed, with some truth, that we have learnt a lesson from the recent naval action on the American waters; but it must be borne in mind that neither of the vessels engaged, nor the ordnance employed were at all comparable to what have been used at Shoeburyness.

To those who, like myself, have gone through the whole series of experiments, the late engagement will appear instructive, but not calculated to cause any great alarm, nor yet effect any other changes than those primarily contemplated by the Government, and such as have been deduced from our own experiments. It is, nevertheless, quite evident that our future navy *must be entirely of iron;* and, judging from the last experiment with the Armstrong smoothbore gun, it would almost appear as a problem yet to be solved, whether our ships of war are not as safe without iron armour as with it. If our new construction of ships are strong enough to carry armaments of 300-pounder guns, which is assumed to be the case, our plating of 6 or 7 inches thick would be penetrated, and probably become more destructive to those on board than if left to make a free passage through the ship. In this case, we should be exactly in the same position as we were in former days with the wooden walls; but with this difference, that if built of iron, the ship would not take fire, and might be made shell proof. It is, however, very different with forts, where weight is not a consideration, and those I am persuaded may be made sufficiently strong to resist the heaviest ordnance that can be brought to bear against them. In this statement I do not mean to say that ships of war should not be protected; but we have yet to learn in what form this protection can be effected to resist the last powerful ordnance, and others of still greater force which are *looming in the distance,* and are sure to follow.

A great outcry has been raised about the inutility of forts; and the Government, in compliance with the general wish, has suspended those at Spithead: I think improperly so, as the recent experiments at Shoeburyness clearly demonstrate that no vessel, however well protected by armour-plates, could resist the effects of such powerful artillery; and instead of the contest between the Merrimac and the Monitor, and that of the 300-pounder gun being against, they are to every appearance in favour of forts. Should this be correct, we have now to consider how we are to meet and how resist the smashing force of such powerful ordnance as was levelled against the Warrior target.

During the whole of the experiments at Shoeburyness I have most intently watched the effects of shot on iron plates. Every description of form and quality of iron has been tried, and the results are still far from satisfactory; and this is the more apparent since the introduction of the large 300-pounder, just at a time when our previous experiments were fairly on the balance with the 40, 68, 100, and 120-pounders. They now appear worthless, and nothing is left but to begin our labours again *de novo.*

It has been a question of great importance, after having determined the law of resistance and the requisite quality of the iron to be used as armour-plates, how these plates should be supported and attached to the sides of the ship. Great difference of opinion continues to exist on this subject,—some are for entirely dispensing with wood; probably the greater number contend for a wood backing, the same as the Warrior and the Black Prince. I confess myself in the minority on this question; and, judging from the experiments, I am inclined to believe from past experience that wood combined with iron is inferior to iron and iron in its power of resistance to shot; and I am fully persuaded that ultimately the iron armour-plates must be firmly attached to the side, technically called the skin, of the ship. It must, moreover, form part of the ship itself, and be so arranged and jointed as to give security and stability to the structure.

The experiments instituted by the Committee on Iron Plates have been well considered and carefully conducted: they commenced with a series of plates selected from different makers of varying thicknesses, and these have been tested both as respects quality and their powers of resistance to shot. They have, moreover, being placed at different angles and in a variety of positions, and we had just arrived at the desired point of security, when the thundering 300-pounder smooth bore upset our calculations and levelled the whole fabric with the ground. We are, however, not yet defeated; and true to the national character, we shall, like the knights of old, resist to the last—

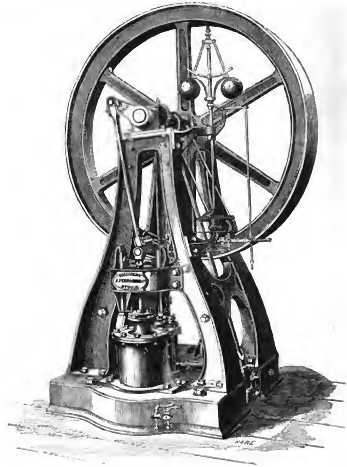
> "And though our legs are smitten off,
> We'll fight upon our stumps."

And thus it will be with the Iron Committee and the Armstrong and the Whitworth guns.

In conclusion, allow me to direct attention to a drawing of the Warrior target, with wood backing and its compeer entirely of iron. The first underwent a severe battering, previous to the attack from the 300-pounder, but the other sustained still greater, with less injury to the plates, notwithstanding the failure of the bolts in the first experiment. It must, however, be admitted that plates on wood backing have certain advantages in softening the blow, but this is done at the expense of the plate, which is much more deflected and driven into the wood, which, from its compressibility, presents a feeble support to the force of impact. Again, with wood intervening between the ship and the iron plates, it is impossible to unite them with long bolts so as to impart additional strength to it; on the contrary, they hang as a dead weight on her sides with a constant tendency to tear her to pieces. Now, with iron or iron we arrive at very different and superior results. In the latter, the armour-plates, if properly applied, will constitute the strength and safety of the structure; and notwithstanding the increased vibration arising from the force of impact of heavy shot, we are more secure in the invulnerability of the plates and the superior resistance which they present to the attack of the enemy's guns. In these remarks I must not, however, attempt to defend iron constructions where they are not defensible, and I am bound to state that in constructions exclusively of iron there is a source of danger which it is only fair to notice, and that is, that the result of two or more heavy shot, or a well concentrated fire, might not only penetrate the plates but break the ribs of the ship. This occurred in the last experiment on my own target, where a salvo of six guns concentrated four on one spot, not more than 14 inches diameter, went through the plates and carried away a part of the frame behind. The same effect might have taken place on the Warrior target; and certainly 9 inches of wood is of little value when assailed by a powerful battery of heavy ordnance and a well concentrated fire.*

In closing these remarks, I have every confidence that the skill and energy of this country will keep us in advance of all competitors, and that a few more years will exhibit to the world the *Iron Navy of England, as of old with its Wooden Walls, unconquerable on every sea.* W. F.

FERRABEE'S VERTICAL DIRECT ACTION HIGH PRESSURE STEAM ENGINE.



FERRABEE'S VERTICAL DIRECT ACTION HIGH PRESSURE STEAM ENGINE.

The above illustration represents the engine which drives the wood cutting and printing machinery in the Western Annex of the International Exhibition. It was manufactured by James Forrabee & Co., of Phœnix Iron Works, Stroud, and 75 High Holborn, London, W.C., and is an engine of a simple, compact, and substantial character, with peculiar mechanical arrangements to ensure its working steadily, effectively, and economically, whether the amount of duty it has to perform be either constant or subject to sudden variations. The frame-work consists of a massive iron base, on which are fixed two strong iron standards braced together by cross-brackets. The cylinder with its slide-valve and a cut-off valve, rest on the base, to which they are bolted, in such a way as to admit of their being easily removed. The feed-pump is fixed on one side of the base. The piston-rod is connected by a cross-head connecting-rod and crank to the crank-shaft, whose bearings are on the tops of the standards, and the fly-wheel is keyed on between them. The governor and its appendages are supported by brackets attached to the standards. The slide-valve, the cut-off valve, the feed-pump, and the governor, are all driven from the crank-shaft. The circumference of the fly-wheel is turned and the crank-shaft is extended beyond one of its bearings to take a pulley or a cog-wheel, so that motion may be transmitted from the engine by means of a strap on either the fly-wheel or a pulley, or by means of gearing, the frame-work being well adapted for the latter. The cylinder has a steam-jacket cast around it, and is fitted with metallic piston and steel piston-rod. The crank-shaft, crank, connecting-rod, and cross-head being fitted with adjustable nuts, by which the wear of the guides can readily be taken up. A cistern is formed in the base into which the steam from the cylinder is discharged to heat water for the boiler; this heated water is supplied to the boiler by a feed pump, made so as to be unfailing in action, and fitted with a safety escape valve.

But the most novel and important feature in the engine, is the simple and effective method of regulating the quantity of steam to be admitted to act on the piston. An ordinary slide-valve, with lap, worked by an eccentric on the crank shaft, gives the steam ingress to and egress from the cylinder in the usual way. Immediately behind the slide-valve, and in connection with the chamber thereof, is placed the improved cut-off valve, which is actuated by an ingenious application of the link motion worked by eccentrics, driven from the crank shaft. This cut-off valve is connected to and controlled by the governor, and by their combined action the proper quantity of steam at its full pressure is supplied to the cylinder at exactly the right moment. The steam is cut off instantaneously at any part of the stroke of the piston, according to any variation that may occur in the resistance to be overcome. By this prompt and perfect self-control, unvarying steadiness in the working of the engine is gained, no matter how sudden or frequent may be the changes in the duty required of it; hence the full benefits of expansion are realized, and great economy in the consumption of fuel is attained. The nominal power of the engine at the Exhibition is 14 horse; but as it is constructed of extraordinary strength, with all the moving parts adapted to a high velocity, it may safely be worked with steam at a pressure of 70 lbs. to the inch, and thus give off double the power nominally ascribed it. The circumstances under which it is working certainly constitute a severe test of its capabilities; placed at the extreme end of the steam pipes, it has to contend with an irregular supply and an imperfect

---

* Since the above was written, another experiment has been made on the Warrior target with the 300-pounder smooth-bore gun. From this it appears that the wood-backing between the armour plates and the skin of the ship cannot safely be dispensed with, and that some compressible or softer substance than iron and iron is necessary to deaden the blow, and absorb the fragments of the shot and the broken plates, which in this instance lodged in the wood, and did not perforate, but only cracked, the skin of the target. From this fact it cannot be denied that this experiment is more satisfactory than those on the iron on iron targets; and however desirous it may be to realize a more effective construction as regards the strength of the ship, it cannot be doubted in so far as the security of the ship and the lives of those on board are concerned, that a vessel with wood backing is safer in action than one composed entirely of iron. In the present state of our knowledge the experiments are therefore against iron and iron, as regards security from the effects of shot, but they are unfavourable as respects the strength of the ship.

SYKES' FILTERING APPARATUS FOR BOILERS.

FIG. 1.

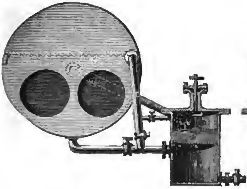
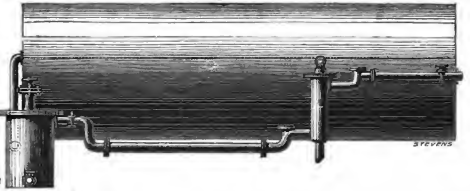


FIG. 2.



exhaust, while the variations in the power required by the machinery driven are unceasing and frequently very sudden. That the engine performs its duty with great steadiness under such conditions must be very gratifying to the makers, and cannot fail to attract the attention of those interested in steam power.

SYKES' FILTERING APPARATUS FOR BOILERS.

The objects of the above apparatus are the removal from steam boilers of the earthy and other matters which are being continually precipitated therein during the formation of steam, and also the removal of any dirty matters which may be mechanically carried into them along with the feed water, before they have sufficient time to form scale upon the interior of the boiler.

The principle of the apparatus is the conducting of the boiler water out from one end of the boiler into a proper filter, and the returning of the clean filtered hot water back again into the boiler, but at the other end than that from which it was taken, whilst the dirt which the filter refuses to allow to pass through it is ejected at pleasure.

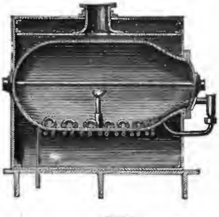
The apparatus will be easily understood by comparing the following description with the above engravings:—

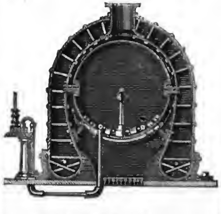
Fig. 1 is a front elevation, and Fig. 2 is a side elevation of a Cornish boiler having the filter attached. The filter is an iron vessel having a rib cast all round to support a perforated bottom, carrying some filtering agent, such as hemp, tow, hair, cotton, or other matter; a perforated cover is placed on the whole and screwed down firmly by means of a hand wheel and screw. The lower part of the vessel which retains the dirt is connected with the bottom of the boiler by a pipe, and has a branch pipe to carry off the dirt from the surface; this pipe is continued across the boiler and perforated, as shown. It is evident that either bottom or surface dirty water may at pleasure be selected for filtration by means of the taps on the pipes. The pressure of the steam forces the water through the filtering medium into the upper chamber, along the outside pipe, shown in Fig. 2, into the pump, from which it is forced through a pipe into the back end of the boiler, thus a continued stream of hot clean water is forced into the boiler, pushing the dirtier water to the filter end of the same, to repeat the same course; the dirt can be ejected at will through the pipe at the bottom of the filtering vessel.

When the filtering medium gets a little clogged with dirt, it can be thoroughly cleansed by reversing the action, suitable taps being provided for that purpose.

The advantages resulting from its use to different branches of industry are very great. The boiler itself being clean inside is never heated to that very high temperature, or in another word, burnt (except from shortness of water), as is always the case when scale or loose dirt intervenes between the water and the boiler, whence the tenacity of the boiler plates is preserved; and as it is believed that incrustation is a fruitful source of explosion, there is no doubt that the application of the filter to steam boilers will greatly diminish the awful amount of loss of life and property arising from this source of devastation, whilst the heat of the fire will be conducted through the clean boiler plates to the water, with much greater rapidity, and, of course, generate steam in the same proportion, and, consequently, the heat of the fire gases will be more fully absorbed by the boiler, and effect a corresponding economy in fuel. The troublesome action of priming will also be nearly done away with, as it is well known that it chiefly owes its origin to dirtiness of the boiler water. By the use of the above apparatus perfectly clean steam can be obtained. This apparatus is introduced by Messrs. T. & B. C. Sykes, of Cleckheaton, near Leeds.

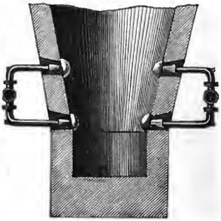
HAYES' STEAM GENERATOR.





A Patent has been obtained by Mr. C. F. Hayes, of the Enfield Small-arms Factory, for an apparatus for generating steam very rapidly. For this purpose a metal pipe of small diameter is employed, but of suitable strength, and laid in coils subject to the direct action of the heat of the furnace. As steam is desired to be generated, water in very small quantities is caused to pass into the heated part or the pipe, by which it immediately becomes converted into steam, which by a valve or other passage passes into another pipe (or an extension of the piping), which is also laid in coils in a superheating chamber, as illustrated in the above engravings, and there terminates in a rose head or other suitable means adapted to finely distribute the steam into this chamber, for the ready conversion of it there into high pressure steam. A small force pump is used, worked by a steam engine or other power, for the purpose of forcing the water from a suitable reservoir into the piping. The superheating chamber is formed and fixed so that the whole surface thereof may, as much as possible, be subject to the direct action of the heat of the fire, and of the heated products of combustion passing therefrom.

HOLCROFT'S BLAST FURNACES.



In blast furnaces of the present construction the tuyeres for the admission of air are arranged on the same level, and consequently act only on one stratum of the ore and fuel in the furnace. The above engraving represents an invention by Mr. G. Holcroft, of Manchester, which consists in the application of additional tuyeres placed on a higher level than the ordinary tuyeres, for causing currents of air to act on the charges in the furnace before they descend to the level of the ordinary tuyeres. By the upper or preliminary blast or blasts, the furnace is kept in better working order, and the ore is better prepared for being converted into metal by the action of the lower blast; the production of the furnace is considerably increased, and the quality of the metal is improved.

PAIL MAKING BY MACHINERY.

IN making a pail it goes through a good many operations, and at each time by a separate individual. The staves are first cut to the proper length; they are then placed into a machine, which hollows out the inside and rounds the outside: they are then jointed, passed from that to be tongued and grooved; they are then ready to be put up, which is done in quick style; as the staves are all cut the same width, there is no time lost in picking out the proper size. They are formed upon an iron cylinder, and turned off on the outside; the hoops, already prepared, are run on tight by a small machine. The insides are then turned out and passed to another workman to have the bottom put in; this is the principal part of the work, although they have to get the ears and bails put on, and painted and varnished, before they are ready for market. One house in Ottawa city, Canada, turns out 800 pails per day.

Correspondence.

[We do not hold ourselves responsible for the statements of our Correspondents.]

A PROPOSAL FOR A PARTIALLY IRON-CLAD VESSEL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER II.

SIR,—In your publication for May 9, No. 176, you inserted a slight sketch of mine of a project for an invulnerable war-ship, although only one-third clad with iron plates. Assuming it to be desirable, although not necessary, in regard to such a vessel, to depart from the routine mode of construction, I ask you to indulge me now in a day-dream concerning some of the structural details connected with this novel design. In former times, I may not have ventured to relate my dream; but the professional mind is now all at sea on nautical subjects, and the public is more than usually disposed to receive with patience new ideas.

The substructure of the vessel I have proposed—distinct from the entire ship, and being, as I have heretofore mentioned, submerged, say two feet under water at the crown—should, I conceive, take the form of a cylindroid amidships, with a conoid at each end, and a softening off at the junctions; that is to say, what would otherwise be a cylinder and cones would have everywhere elliptic sections, and the conjugate diameter would be vertical. The longitudinal lines would be straight except at the junctions. Concave lines might be introduced at the bow; and there are many advocates for such lines, both among practical men and mathematicians; but I confess I never could perceive the propriety, nor even the relevancy, of Mr. Scott Russell's mathematical theory of the wave line to the actual circumstances of liquid resistance. This parabolic curve line corresponds to acceleration; but why accelerate the motion of displaced water? Motion may be propagated subsequently to displacement under such laws; but that is a secondary effect. The true and simple principle, I conceive, is merely to move the particles of water in translation by displacement, laterally as far as may be, with uniform velocity, and with as little thereof comparatively to that of the ship, as practical considerations will permit; which principle, as carried into effect by the straight lines of the bow of a ship, is that of the inclined plane. The reason why it economises work in this case—which in respect to a weight, or to a constant resistance, it does not—is, because liquid resistance is proportional to the square of the velocity. The vessel moves with a uniform velocity, and so would the water be moved if it were let alone; and I cannot conceive why, by the parabolic form of the bow, it should be coerced into acceleration. I know of many reasons why it should not, of which two, sufficiently cogent, are these—that the buoyancy of the bow, so very desirable at this point, is very much lessed, and the resistance of the water is doubled, so far, at least, as friction against the side of the vessel (not that among the particles themselves) is excluded. So far as my reading extends, this is the first time—and I beg of you to take a note of it, Mr. Editor—that straight lines at the bow of a vessel have been advocated in principle as the form of least resistance, and that curve lines on principle, also, have been condemned. If any mathematician dissents from these views, I beg to refer him to the subjoined note (perhaps Mr. Editor would prefer to insert it as a distinct paper), where I think I am entitled to say they are demonstrated.[*] I am open to correction, and, what is more, to conviction; but methinks the theory, the subject of my animadversion, is another instance to be added to the many mathematical illusions I have, at various times, adverted to in your pages, which beset practical science, and act as a snare to practical men—arising, in most cases, from a belief in the truth of the conformability of mathematical principles to concrete and circumstantial matters, simply because they are true in the abstract, or because they have the prestige of having been incautiously and unpractically so applied by eminent but theoretical mathematicians. As an instance of an error of this kind, though long since exploded, yet peculiarly *apropos* to the case in hand, because ignoring the same sort of resistance—was the assumed parabolic path of projectiles.

I propose, therefore, to give straight lines to both the stem and stern of the substructure of the vessel, and to make them as fine as may be practically useful—that is, I would go no further in this direction of acuteness of form than the point beyond which friction would render any advantage nugatory, a point determinable in a measure by the possibility of applying a copper sheathing. I would, in regard to the whole, adopt a length as extreme in proportion to width as would also be practically useful under the same condition in respect to friction, rather than what would be constructively practicable. This would rest at a point where, to obtain the desired amount of tonnage, increased friction would dictate an increase in width rather than in length, in order to secure the minimum of resistance. But where that point is who can tell? I suspect it is beyond, and not within, the point of constructive practicability, provided always that there exists a clean copper coating. These are points arrived at gradually and tentatively, respecting which the enterprising but prudent shipbuilder is the best authority. I think, however, we might now venture upon a proportion of one to ten, in regard, at least, to the form I am now proposing.

So much for the form—now for the construction, which, in my opinion, should be of wood and iron. I am quite in accordance here with Mr. J. E. Reed, in receiving with impatience objections to the mixing and uniting of these materials in a vessel, for the validity of such scruples may be dependent on—and, I think, does depend on—sterility of invention. Strength, stiffness, and elasticity (I use these terms in their popular sense, for, in strict science, stiffness and strength are both forms of elasticity) combine to produce an invaluable quality, which the conjoint use of these materials secures. It was for want of this that the Royal Charter went to pieces so rapidly, and which has necessitated in the Great Eastern a cellular formation, and also in iron vessels generally a comparative superabundance of that material, without securing elasticity after all. Strength and stiffness are indispensable; but in obtaining these with a material like iron exclusively, *extreme* rigidity is the result, under which shocks as affecting the whole become terribly severe, whilst liability to local injury remains as before.[†] Now, the way I would conjoin wood and iron would be after this manner, and it will apply to all forms of vessels. Let the substructure be put together in vertical sections, that is, in elliptical rings, to be alternately iron and wood. Let the iron rings be half-inch in thickness; and as to depth, they should vary according to the diameter of the cylindroid, and the varying diameters of the conoids. Let the rings of wood be of like depths, but three inches in thickness. This would make the weight of the exterior case about twice that of what it would be if constructed wholly of wood; but the depths might be reduced one-half, and then equal weights would leave a balance of strength in favour of the composite materials. The tensile strain would be met by the lateral junction of the iron rings through the intervening wood, by means of two rows of screw bolts near their inner and outward circumferences, but aided by longitudinal strakes of iron on the interior surface. The building would commence with the middle iron ring of the cylindroid, on the two sides of which would be placed rings of felt saturated with tar and grease; next to these, rings of wood; then rings of felt, and again rings of iron, when the whole of them—three of iron, two of wood, and four of felt—would be screwed up together. The successive series of these materials being added on each side by means of the alternate rows of bolts, the work would rapidly advance both towards stem and stern. This construction [illegible] at once the difficulty about the copper covering of iron vessels, for the external edges of the iron rings should be a little within those of wood, and be covered over with felt. The excess of wood allows, too, the shipwright to make all fair and straight for the surface. But your limits oblige me now to conclude for the present.

Yours truly,
BENJAMIN CHEVERTON.

May 21, 1862.

---

[*] On another paper.

[†] This applies to ships, but in other cases where local injury is less certain, its liability is increased by rigidity, and its severity also in regard to the intensity of the injurious action. Two eminent practical men, who thought they could do without elasticity in a target, have recently learnt, by practical experience, how that evil effects, resulting from both local and general concussion, are aggravated by the omission; and another eminent man has learnt that such a form of elasticity which india-rubber affords under such a mode of applying it as he adopted was utterly inefficient in one of these respects, and worse than inefficient in regard to the other. On the other hand, a wood backing appears to afford the form of elasticity which corresponds best to the somewhat incompatible conditions of the case, but yet with too great a bias towards the destruction of the bolts. Railway engineers, too, needed experience to teach them that wood is better than stone to support their rails.

THE STRAIGHT LINE *VERSUS* THE WAVE LINE, FOR VESSELS.

SIR,—The wave line theory is based on the assumption that, independent of friction against the ship's side, the resistance opposed by water to her progress is due to the inertia of the water laterally moved from her course, as though it were one entire body, and of course in one direction, with increasing velocity and momentum under the constant force applied: that, in fact, the case is analagous to the fall of a body with accelerated motion under the action of gravity, and represented as to velocities and spaces by the abscisses and ordinates of a parabola. Hence the necessity of parabolic curve lines to form the bow of a vessel. But this theory has no conformity to the actual phenomena of the case, which find their analogy rather in the fall of a feather in the air with uniform motion. The particles of water displaced in a line normal to the ship's course, although they might be under a constant force, have not primarily any tendency to move with acceleration as in free space, whatever kind of movement may ultimately take place. There is obstruction in the way—a resistance other than the inertia of the particles immediately acted on—requiring at once an increased force. As in the case of nearly all kinds of resistances pertaining to practical operations, they move only as they are moved, and are the subject matter of work, and not of momentum as a matter of calculation. To produce an acceleration requires an increasing force in this case. Owing to the mobility of water, its particles move not in these circumstances as a body, but in varying quantities with various degrees of velocity, and in all manner of directions; and thus, besides the inertia of all that quantity or proportion of the water in motion, of which the motion is derived from the vessel in such manner as to consume force, and which is not likely to be exactly proportional to the velocity, there must be a considerable amount of resistance (relatively larger at moderate velocities), due to the friction generated in the water itself. The result of the whole is, that the resistance may be somewhat more or somewhat less than proportional to the square of the velocity of the disturbing body, according to the circumstances of the case. Mathematicians represent the law and valuation of this resistance by the formula $\frac{V^2}{2g}$, but this is not merely an approximation, it is also purely an empirical expression, and yet, by a singular illusion, it is commonly accepted, and propounded too, as the symbolization of the scientific principles truly applicable to the literal realities of the case. There would more consistently be an assertion of pretension to a scientific expression, not indeed of the real, but of the assumed facts, if the formula was thus given $\frac{V^2}{g}$; and results so determined would not, I believe, be less, but more, in accordance with those derived from experiments. The greater approximation, however, arises merely from a compensation of errors in the theory, and is no verification thereof.

Well, the resistance being assumed proportional to the square of the velocity, and the water, therefore, not admitting of acceleration without being coerced into it, the question is—What is the difference between the amount of work done, by moving it in this manner through the action of surfaces at the bow of a vessel moulded with parabolic curve lines, or by moving it with uniform velocity by means of surfaces formed of right lines inclined at the same general angle? Now, resistance in this acceleration commences with zero; therefore, one-half of the product of the ultimate resistance into the distance traversed (normal to the ship's course), or, which is the same thing, the product of the mean of the resistances into the same, will be the work done in the first case. Again, if the same distance is traversed in the same time with a uniform velocity, and, consequently, with a constant resistance, such resistance being proportional also to the square of the velocity, the product of the same into the distance will be the work done in the second case. But the mean of the squares of the velocities is double the square of the uniform velocity; for the latter is identical with the mean velocity; therefore, as the resistances follow in the same proportion, and are multiplied into the same distance, the work done is in the same proportion, namely, two to one against the wave line. I think I may append to this Q E D; but I am not sure the conclusion may not be modified slightly by the influence of circumstances possibly omitted. In practice, also, the wave line surges gradually into a straight line at the surface of the water; and it should be noticed, too, that this doubling of the work by the curve line concerns only that portion of the resistance which, depending on the square of the velocity, is needlessly augmented by an accelerated motion. The friction, therefore, of the vessel is excluded, although its law of resistance should be that of the square of the velocity; but not so the friction of the particles of water, if that be increased by velocity. These circumstances greatly lessen the ratio of the loss of power.

Benjamin Cheverton.

May 31.

ATTACHING ARMOUR PLATES.

Plymouth, June 9th, 1862.

Sir,—I beg to acquaint you that I have forwarded to your office a model of my plan for attaching armour plates to ships' sides, which I would like you and your correspondent, "Civilian," to see before it goes to the Admiralty.

When you have examined the model, perhaps you will be good enough to send it on to the Admiralty. You are at liberty to make any comments upon it you may think proper. Your obedient servant,

W. R. Mulley.

SUBMARINE EXPLOSIVE SHELLS.

Sir,—By the *Temple Bar* magazine of last month in an article upon "Iron war vessels and heavy ordnance," we are informed that some submarine explosive shells are in the course of construction at Woolwich.

The progress in the science and art of war embraces the appliances of the chemist; but so intent have hitherto been the authorities, to whom our national defences are intrusted, upon the capabilities of ordnance, that they have not, apparently, directed their attention to the employment of engines whose capabilities of destruction are vastly superior when expended, not upon the top sides, but the bottoms of ships, and the larger the ships so operated upon, the less chance have they of swimming.

This could be proved by a few experiments not necessarily expensive, and which, if carried out, might save many millions now being wasted upon useless structures. John Harvey, Capt. R.N.

Cheltenham, June 16, 1862.

THE SAND EPOCH.

Sir,—Geology and Genesis are hard to reconcile. But it may be that geology is more in fault than Genesis. The one appeals to our reason, and the other to our faith. In a higher state of knowledge the apparent contradiction may vanish. In the meantime faith is tried. Personally I confess to perfect reliance on Genesis, and on the Pentateuch at large, despite all the flint arrow-heads of the stone era. I am bold enough to say,—"Let the geologists go on, the faster they go the sooner they will outrun their philosophy." I anticipate the day when they will gain some lofty ridge of discovery, from whence they will have an unexpected glimpse of that which now they see not; and in a moment, as it were, the semi-sceptical notions which accompanied them thither, will be scouted from their presence as childish errors. As things are now, let us just pause at one point of their onward journey, and ask a question or two.

What is the geology of the Desert? In no geological work which I have had the pleasure of reading, have I met with any information on this subject. Perhaps I have not read far enough. If so, probably one of your readers will correct me. In the meantime, may I be allowed to speculate a little? First, whence came the sand? A few years ago, a river burst its banks in France. When the waters receded, the meadows once so verdant were covered with sand, and fertility gave place to barrenness. May not the Sahara in Africa, and the great salt desert of Persia, with other arid wastes of the Eastern world, have been occasioned by a similar but more extensive catastrophe? The oases of the desert seem to tell of a rich and once luxurious soil beneath, now overwhelmed (if we may use the expression) by an ocean of sand. Lake Asphaltites was once "as the garden of the Lord,"—at least I believe it,—and why not apprehend the same of the gigantic deserts of Asia and Africa? Geologists have said, and I suppose they say so still, that the Noachic flood "has left no trace of its existence, on the surface or in the interior of the earth." Strange if the wide-spread desert should prove the abiding monument of that tremendous desolation!

Has any one ever dug in the desert? Dug, I mean, through the sand, as an engineer would make a coffer-dam down to the bed of a river. Layard dug through sand-heaps at Mosul and found Nineveh. Why should not another Layard channel his way through some desert waste and find traces of the antediluvian epoch? Where are the art trophies of the old world? Are they swept into the ocean depths? Or are they trodden over by the weary feet of lonely caravans? "The poker and shovel of Tubal Cain" may not be discoverable; but surely the era of giants (why not believe in giants as well as those unfixable arrow-heads?) is not without some substantial records of its skill and prowess. Shall we go from Dan to Beersheba, and say, "It is all barren?" Deserts may prove rich in relics, and these unstratified deposits may tell a tale rather more congenial to a Bible reader than some of the stony theories of this material age.

Yours very truly,

Joseph Pitter.

1a Guildford Road, Greenwich, S.E.,
June 16, 1862.

TO CORRESPONDENTS.

Received.—W. R. M., W. A., M. and Son, R. L., English Mechanic, San Francisco, M. Melbourne, S. P. D., E. H., A. G., H. and W.

Telegraphic Intelligence.

A NEW ATLANTIC SURVEY.

The *Hampstead Telegraph* says:—"The paddle-wheel steam surveying vessel Porcupine, 3, Master Commander Hoskyn, appointed, on the application of the directors of the Atlantic Telegraph Company, to take soundings in the Atlantic, will be provided with a donkey-engine on deck to assist the men. The machines which will be used are those called the "Bulldog" machines. They are constructed on the principle best adapted for bringing up portions of the bottom. Brooke's apparatus will also be employed. The Porcupine, it is expected, will in the first place proceed to that part of the Atlantic where there is what is popularly called a "cliff" in the bed of the ocean, at which point it is supposed the former cable was broken. At the head of this declivity, about 200 miles from Ireland, there is a depth of 550 fathoms, and at the foot 1,750 fathoms, showing a difference of 1,200 fathoms. But this decline extends over a distance of eight miles, so that the fall is only one in eight. Other portions will no doubt be sounded. It is stated that in the event of a second attempt to establish telegraphic communication across the Atlantic some place on the coast of Ireland, further north than Valentia harbour, will be selected for the purpose of obtaining a more convenient bed for the reception of the wire. The burden of the Porcupine being only 382 tons, she is rather small for the duty. The donkey-engine alone will weigh 10 tons, and this, with the fuel necessary to be kept near it on deck, may cause her to roll, especially when her coal is diminished. While employed sounding very little coal will be expended, but as she cannot stow above 100 tons frequent communications with the shore will be necessary. Galway, or some other western port in Ireland, will be visited for this purpose. Mr. John E. Davis, Master, R.N. (borne on the books of the Fisgard), who has had great experience in surveying, and who accompanied Captain Allen Young in the Fox, in 1860, to survey the proposed northern route *via* Faro, Iceland, Greenland, and Labrador, has been appointed by the hydrographer to go in the Porcupine for the purpose of aiding the present inquiry."

The Albany and Boston Railroad Company have recently had two passenger cars refitted for the special conveyance of wounded soldiers. About half the seats in each car have been taken up, and the places filled with berths, six on a side, which are furnished with hair mattresses and pillows, blankets, and covers. They are designed to accommodate some thirty soldiers each, twelve in berths, and the others in seats. Each car is to be furnished with a saloon.

Gossip.

An experiment has been made at Cherbourg, in preserving wood for vessels from being affected with dry rot, by subjecting the timber to a slight carbonization with common inflammable coal-gas. The result is stated to be completely successful.

A long iron railway-and-road-bridge for spanning the Jumna, near Delhi, is being made by Messrs. Ormerod, Grierson, & Co., St. George's Ironworks, Hulme. It is for the East-India Railway, and is the design of Mr. A. M. Rendel, C.E. The bridge will consist of twelve arches of 205 feet span each, and will be half a mile long.

Mrs. Ellen Hope has presented to the National Life-boat Institution £340 in memory of her late husband, the Rev. Frederick William Hope, for the purpose of enabling the institution to station a new life-boat and transporting carriage at Appledore, on the north coast of Devon, where some fearful shipwrecks take place nearly every winter.

During the engagement before Richmond Professor Lowe's balloon hovered over the Federal lines at an altitude of about 2,000 feet, and maintained successful telegraphic communication with General M'Clellan at his head-quarters. It asserted that every movement of the Confederate armies was distinctly visible, and instantaneously reported.

On Saturday morning the adjudication was made by the consulting architect upon the competitive designs for the new Exchange buildings proposed to be erected in New street. The consulting architect presented an elaborate report, stating the grounds of his decision, which was favourable to the design marked, "*Ars Artificem Probat*" (Mr. Holmes). To Mr. Cranston, architect, is awarded the prize of £100, and to Mr. H. R. Y. Thomason, the prize of £50.

A new coal-cutting machine, worked by compressed air, has been lately tried with success in Yorkshire. The engine-house contains a powerful engine, besides the compressed-air engine. The "pressed air" is conducted in patent bitumenised pipes to a distance of nearly a mile from the bottom of the driving shaft, the pressure being about 50lb. to the inch. The agency is said to be delivered to the cutter almost with the same motive force that it has at the pit-head. The cutter itself is a machine made to run on the tub carriage way. While the cutter is working, a stream of pure atmosphere is discharged at every stroke; and this current of fresh and dry air cannot fail to add considerably to the ventilation. Economy and safety are said to be the chief recommendations of the invention.

A series of interesting trials with various screw propellers, with a view of ascertaining their comparative merit, came off at Stokes Bay, near Portsmouth, on Monday week. The Shannon, 35, Captain James F. B. Wainwright, steamed out of Portsmouth harbour in the morning, having previously been fitted with a six-bladed screw, the first ever brought into use, we are informed, to test the excellence of the invention. On arriving at Stoke's Bay she made six runs at the measured mile, drawing 20 feet 2 inches of water forward and 21 feet 9 inches aft. The result of these runs gave a speed of 11½ knots per hour, the mean revolutions of her engines being 49 per minute. The first circle, with helm hard-a-port, was described in 7 min. 8 sec., and the second, with helm hard-a-starboard, in 7 min. 57 sec. Revolutions of engines 48 per minute. There was no vibration, but the trial, as far as the speed was concerned, was not so successful as the previous trial. This frigate will shortly make another experiment with a three-bladed screw.

"On Saturday afternoon," says the *Morning Star*, "experiments to test the merits of a portable fire escape, which has been invented by Mr. Hartigan (of Brighton, we understand), were made at Scotland Yard, under the authority of Sir Richard Mayne. Mr. Hartigan's apparatus is very simple in its construction. To an iron frame, which can readily be fixed on a window sill, ropes are attached by means of pulleys, and to these ropes a travelling bag is on each side secured by a series of eyes or rings. The experiments were made from a window in the police station about thirty feet from the ground. The ropes were guided by four men standing on the pavement, and in four minutes after the frame had been fixed on the sill seven individuals had been safely brought down from the imaginary conflagration. The experimental family so expeditiously rescued from the "element" which was supposed to be "devouring" the station consisted of boys and girls of various ages, a grown up woman, and Mr. Hartigan. It is but justice to the inventor to say that with the exception of himself none of the illustrators had before encountered the danger of making a descent in the sack. In another experiment three stoutish children were successively rescued in a minute. It struck us that some details in the escape might be easily improved so as to secure greater safety, but the efficiency of what may be called the principle of the invention was successfully proved by the experiments."

Potabilisation of Sea-water by the Electric Current.—In *Macmillan's Magazine* for this month is an interesting paper by Dr. Phipson, entitled, "Electricity at Work," in which the author passes in review the useful applications of this wonderful agency. He concludes his paper as follows:—"Reflecting upon the powerful decomposing chemical force with which we are furnished by the electric current, it occurred to me that I might be able to render sea-water potable by decomposing and extracting its salt, by means of a moderately powerful battery. The experiments were made at Ostend a few years ago. My apparatus consisted of three vessels containing sea-water; the centre one contained the water to be operated upon, the two others communicated with the two poles of the battery. The three vessels were connected by two bent Ω-tubes filled with sea-water. As the only battery I could procure in Ostend was rather weak, I passed the current through the water for about fourteen hours, after which one of the outside vessels had become acid and the other alkaline. The sea-water was then filtered through charcoal, and was nearly drinkable. It would have been, I doubt not, quite potable had the battery employed been more powerful, as it was I found it difficult to extract the last particles of salt; and the water after subsequent trials, still presented a slightly brackish taste. I have not had an opportunity of repeating this experiment since, but from the results obtained, I think it probable that sea-water may be rendered potable by means of the electric current."

The Brighton Sewerage.—Brighton has resolved to clean herself. A scheme of sewerage adequate to the wants of the town has been determined upon. The slovenly and detestable plan of running the sewage into the sea, to generate abominable odours by reaction with the salt water, has been wisely condemned. This and the other main principles laid down in these pages have been adopted as the basis of the new system. A main sewer will collect all the sewage of the town, and convey it to an outfall to the east of Rottingdean. At this point it will be discharged into the sea twice in twenty-four hours, and the current will sweep it eastward, avoiding the risk of annoying any inhabitants of the coast. As the whole cutting will be through chalk, the construction will be easy and inexpensive. It is estimated that about £30,000 will accomplish this important undertaking. Thus, for a sum which must be regarded as trifling in relation to the wealth of Brighton and the benefits that must result from the outlay, the town will be redeemed from the reproach of uncleanliness and disregard to the health of the visitors In accordance with the principle of the London main drainage scheme, provision is made for an outfall. But the plan is perfectly compatible with the utilization of the sewage for agricultural purposes. At any part of its course through the main sewer leading to Rottingdean it will be quite feasible to pump out liquid sewage and to apply it to the land. That this—the proper destination of the sewage—will eventually take place we entertain no doubt. Mr. Brady's Committee will, it is hoped, not break up without demonstrating the methods of rescuing the sewage of towns from utter waste. The self-cleansing ordinance adopted by the inhabitants of Brighton is an ample vindication of their public spirit. We, who, like all other toiling denizens of the great metropolis, have a personal interest in the salubrity of this beautiful watering place, rejoice in the decision. As sanitary monitors, we are especially glad that the advice we felt it our duty to urge has been adopted in so liberal a spirit.—*Lancet.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 2979, 2982, 2998, 3045.
Boilers and their Furnaces, &c., 2999, 3011.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3000, 3007, 3009, 3014.
Ships and Boats, including their fittings, 3023, 3024, 3051.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 2989, 3019, 3039, 3053.
Food and Beverages, including apparatus for preparing food for men and animals, 3005, 3049.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2973, 2980, 2983, 2995, 3021, 3026, 3037, 3040, 3046.
Buildings and Building Materials, including sewers drain-pipes, brick and tile machines, &c. 3017.
Lighting, Heating, and Ventilating, 2993.
Furniture and Apparel, including household utensils time-keepers, jewellery, musical instruments, &c., 2984, 2985, 2988, 2990, 3001, 3003, 3004, 3008, 3010, 3013, 3016, 3020, 3022, 3028, 3032, 3050.
Metals, including apparatus for their manufacture, 3002.
Chemistry and Photography, 3043.
Electrical Apparatus, 2991, 2997, 3015.
Warfare, 2978, 2992 3018, 3036.
Letter-Press Printing, &c., *None.*
Miscellaneous, 2972, 2974, 2975, 2976, 2977, 2981, 2986, 2987, 2994, 2996, 3006, 3012, 3025, 3027, 3029, 3030, 3031, 3033, 3034, 3035, 3038, 3041, 3042, 3044, 3047, 3048, 3051, 3052.

2972. C. Stevens. *An indelible anti-corrosive ink.* (A communication.) Dated Nov. 26, 1861.

The object here is the production of an ink capable of resisting any chemical reagent, and possessing other desirable qualities. The colouring matter principally used is known under the name of aniline. Three colours are at present known, viz, violet, red, and blue; these the patentee uses singly or combined, or mixed with other colouring matters. The other ingredients are active acid, water and gluten; the active acid can be replaced either by chlorhydric, tartaric, malic, citric, or gallic acid. *Patent completed.*

2973. G. Bottomley. *Improved machinery for cutting up linen, cotton, woollen, and other rags, fibrous waste, or vegetable substances, for various purposes in the industrial arts.* Dated Nov. 26, 1861.

This invention consists mainly in an arrangement of rollers, one of which is provided longitudinally with a series of blades, having angular cutting edges, acting in combination with certain flat metal bars fixed in the periphery of another roller, and whereby the rags are cut or torn. There are other detailed arrangements. *Patent completed.*

2974. D. Ker. *An improvement in the manufacture of soap.* Dated Nov. 26, 1861.

Here the patentee introduces gluten into soap containing sulphate of soda, whereby the soap is prevented from being incrusted with an effervescence of soda. *Patent completed.*

2975. W. Firth and R. Ridley. *Improvements in apparatus and machinery for working coal and other mines.* Dated Nov. 26, 1861.

This consists in applying hammers, actuated by compressed air, in order to drive suitable cutting tools into the face of the mineral in coal or other mines which are being worked, and so as to form longitudinal grooves or narrow cuttings to the extent required into the coal or other matter forming the upright face of the work. *Patent completed.*

2976. J. H. Johnson. *An apparatus for supporting the womb in cases of prolapsus uteri.* (A communication.) Dated Nov. 26, 1861.

This apparatus, which may be made of hardened india-rubber, consists of a ring, which is connected by swivel joints to two link pieces, situate diametrically opposite the sides of the ring, the opposite ends of the link pieces being respectively jointed to the outer ends of two expanding wings. These wings are jointed or hinged together in the centre of the apparatus, similar joints or hinges being formed across the ring for enabling the apparatus to be closed or contracted when being inserted into the vagina, and expanded or opened out when properly adjusted in its place. *Patent completed.*

2977. G. E. Donisthorpe, W. Firth, and R. Ridley. *Improvements in machinery and apparatus for working coal and other mines.* Dated Nov. 26, 1861.

This consists in combining compressed air engines with picks and cutting tools, which are mounted on carriages moved on and guided by rail or tramways, such picks or cutting tools being arranged to cut longitudinal, horizontal, and also upright grooves to the desired depth or extent into the upright face of the work, and thus to divide the work into rectangular sections, each section being bounded by grooves on three or four sides. *Patent completed.*

2978. G. L. Purchase. *Improved sight apparatus and sight for fire-arms and ordnance.* Dated Nov. 26, 1861.

This sight apparatus is composed of a frame by which it is attached to the fire-arm, and a sight mounted on the frame. The sight serves as a foresight to the fire-arm, in addition to, or instead of, any sight it may be usual to put to a fire-arm near its muzzle. The sight may be made to move on the frame in a direction transverse to the axis of the barrel of the arm. Occasionally the inventor uses a packing when the part of the apparatus that should fit the fire-arm is too large, or from other causes does not fit the fire-arm. The peculiar feature of the improved sight is that it is wholly supported and retained in a required position by a bar or rod which passes through the block of the sight, and the length of which is transverse to the axis of the barrel of the fire-arm, and also in a horizontal position, supposing the fire-arm to be pointed or directed. *Patent abandoned.*

2979. J. Standfield. *Improvements in apparatus for regulating and indicating the speed of steam engines and other machinery.* Dated Nov. 27, 1861.

The first part of this consists in apparatus for indicating the number of revolutions or speed of the machinery to which it is attached, and at the same time giving motion to or regulating the valve or apparatus, which constitutes the second part of the invention, the said valve or apparatus being that through which the steam or other fluid is supplied to the cylinder or machinery to be regulated. The apparatus for indicating the speed of the machinery consists of a cylindrical or otherwise shaped vessel, wholly or partially filled with water or other fluid, and in which fluid a fan or series of fans is caused to revolve with more or less rapidity, and thus to raise a column of the said fluid to a greater or less height in a tube connected to the said vessel; or the pressure of water may be exerted against any ordinary pressure gauge, the dial or tube being marked with figures corresponding to the speeds of the machinery. The tube may be fitted with a float or have air enclosed at its upper end. To compensate for evaporation the said tube may itself be supported on the surface of the water by means of a float, thus keeping its position in reference to the level of the fluid. Motion is given to the fan or fans of toothed wheels, a strap, or catgut, or other band. *Patent completed.*

2980. F. A. Calvert. *Improvements in machinery or apparatus for burring, carding, and combing wool and other fibrous substances.* Dated Nov. 27, 1861.

These improvements in burring wool, &c., consist in conveying the currents of air from the under side of the toothed drum and retaining roller, instead of from above. The improvements in carding engines consist in stripping the main cylinder from the "lickers in." The improvements for combing consist in the combination of a comb belt or chain with a carding engine. The improvements also consist in making cylinders of sheet iron to be covered with card clothing, or with non-elastic teeth. *Patent completed.*

2981. F. P. Dumarchey. *Improvements in machines for crushing and pounding stones, ore, and other materials.* Dated Nov. 27, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2982. G. Rydill. *An improved Cornish or other steam boiler, with smoke consumer and condenser, being also applicable for ventilation.* Dated Nov. 27, 1861.

This consists of an improved Cornish or other boiler, with smoke consumer and condenser. According to one part of the invention the inventor cuts a hole through the tubes or flues of a boiler, so that the grate bars are fixed at the bottom of the tubes or flues, by which the whole area of the fire box remains heated, shutting up the whole of the space which is now used to admit cold air. The fire receives its air from the bottom or sides of the boiler, which is so formed that a culvert or subterranean passage conducts the air to the fire, by which means a powerful blast draught is obtained. He fixes a draught ash box to admit air to the grate bars where the culvert or air passage is not fixed. There is much other detail which we cannot advantageously devote space to here. *Patent abandoned.*

2983. W. Leek. *Improvements in weaving, printing, and otherwise treating certain ornamental fabrics.* Dated Nov. 27, 1861.

This relates to ornamental woven fabrics resembling what are known as crimped goods, in which crimped or full stripes running the long way of the cloth are alternated with scant or plain strips, and the invention consists in making the scant or plain parts single fold. The warps for the band parts are drawn off a beam separate and distinct from the beam supplying the warps for the crimped or full parts, and the two sets of warps are differently placed, and are actuated by different heddle leaves. But to make the band single fold and scant, or short as compared with the crimped parts, the warps composing it are shed so that two or more weft threads are laid in each shed, each shed being kept open, or being repeated for two or more shots, whilst the shed of the warps for the crimped parts is changed at each shot. *Patent abandoned.*

2984. J. Cook. *Improvements in pendent lamps.* Dated Nov. 27, 1861.

This relates to the class of pendent lamps in which three, four, or more burners project outwards "star fashion," or in different radial directions from the lower part of the pendent pipe in the case of gas lamps, or of the central oil lamp, and consists in arranging within the burners, and so as to overhang them, a series of three, four, or more segmental reflectors. These reflectors are shaped so as to present in both horizontal and vertical section curved lines, which are hollow and concave outwards and downwards towards the burners. The reflectors are made to overhang, in order to reflect the light chiefly in a downward direction, to render the lamps suitable for overhead or elevated positions in shops and railway stations, &c. *Patent abandoned.*

2985. A. Whibley and T. Lumley. *Improvements in ventilators.* Dated Nov. 27, 1861.

This invention consists in constructing the louvres of ventilators of oiled skin, cotton, cloth, or other suitable flexible material. *Patent abandoned.*

2986. H. Brambach. *A new mode of manufacturing gas for illuminating purposes.* Dated Nov. 27, 1861.

This consists in passing hydrogen gas, prepared in the usual manner from sulphuric acid diluted with four or five times its bulk of water and fragments of zinc or iron, through a vessel containing some easily valatilized hydro-carburet, such as benzine, or the essence of turpentine. *Patent abandoned.*

2987. A. Barclay. *Improvements in machinery or apparatus for boring and winding purposes.* Dated Nov. 27, 1861.

This invention consists in the arrangement and construction of machinery, adapted for facilitating the operation of boring for minerals or water, and also for winding the boring rods and the pump used for clearing the bore. The details of the invention cannot be quoted here. *Patent abandoned.*

2988. H. Mearing. *An improved lucifer match and prepared paper for igniting the same.* Dated Nov. 27, 1861.

Here the patentee takes splints made either of wood, wax, or other substance, and dips the ends in melted sulphur; when dry he again dips them in a composition made in the following manner:—He takes of powdered potash ten parts, oxide of antimony 4 parts, smalts 5 parts, gum 2 parts, and reduces them, adding a sufficient quantity of water to form a paste. After being dipped in the above-mentioned paste, the match is dried in the usual way. In the manufacture of the prepared paper, he first makes the following composition:—He takes flour or glue and renders it into a paste. To 2 parts of this paste he adds amorphe phosphorous 6 parts, graphite in powder 1 part, and silicate of soda 1 part; these substances must be intimately mixed together, and the paper is to be coated with this preparation by a brush or other means, and dried. *Patent completed.*

2989. A. V. Newton. *Improvements in mowing and reaping machinery.* (A communication.) Dated Nov. 27, 1861.

Here the frame, which has the gearing of the mower attached thereto, is suspended upon trunnions secured upon the sides of a collar or box, working on the axletree of the propelling wheels, for the purpose of making the cutters secured to the lower end of the frame self-adjustable, and causing them to adapt themselves to the surface of the ground, whether the inner or outer end of the cutter lid be lifted or depressed in passing over slight inequalities in their track. For transmitting the motion from either of the travelling wheels to the cutter bar, a compound or double acting coupling box is used. This coupling box is so combined with the driving wheels and gearing of the machine that each driving wheel, through the agency of clicks taking into ratchet teeth within the box, may act thereon independently of the other to operate the gearing which transmits the motion to the cutter bar crank, and thus permit the machine to be worked to the right or left to cut the grass or other standing crop. *Patent abandoned.*

2990. W. Clark. *Improvements in the clasps or fastenings of purses, bags, portfolios, tobacco pouches, and other like articles.* (A communication.) Dated Nov. 27, 1861.

Here the purse, bag, &c., has two catches instead of one, which are placed one at each side of the frame or mouth of the purse, bag, &c. The opening is effected by a spring placed round the axis of rotation of the two closing frames, which spring tends constantly to open the frame or mouth of the purse, bag, &c., in such way that, whence unlocked, the springs act so as to open it automatically. *Patent completed.*

2991. W. Clark. *Improvements in the construction of parts of electric telegraph belt apparatus, and in apparatus used in making the same.* (A communication.) Dated Nov. 27, 1861.

This invention is not described apart from the drawings. *Patent completed.*

2992. J. H. Soller. *Improvements in cases for holding and supplying caps to the nipples of rifles and other fire-arms.* Dated Nov. 27, 1861.

Here the inventor constructs a flat box, adapted to hold a number of percussion caps, which are all introduced in one position, and though loose and free to move about in it, cannot become inverted, which is usual in such boxes. It is tapered and constructed at one end, where they are delivered, so that only one can pass out at a time. At the orifice are two spring pieces which embrace the body of the cap, and grip it slightly, the one curling round so as to prevent the cap moving beyond it in a direct line. This extremity of the case takes also the same form, being semi-cylindrical, and having an opening at the side for the cap to pass out; suitable slots are formed in it for the passage of the flanch of the cap. An opening is made in the flat side at the exit passage of the entrance of the nipple, in the direction of the axis of the cap, which opening unites by a suitable slot with that before stated for the passage of the cap, which permits the cap to pass out on the nipple; this it does in a direction at right angles to that in which it passed from the box to the position it takes in readiness for capping between the spring pieces. *Patent abandoned.*

2993. M. Ohren. *An improvement in the manufacture of gas, and the apparatus connected therewith.* Dated Nov. 27, 1861.

It is a known fact (the inventor states) that although a gas exhauster working at level gauge draws off a considerable portion of the gas produced in a retort, still a pressure is maintained in the retort equal to the seal of the dip pipe, from two to four inches, and that, consequently, a large portion of gas is thereby destroyed in the retort. He claims to remove this pressure from the retorts, and for the most efficient means of doing so he claims the use of a moveable disc, whereby the water in the hydraulic main is kept at one uniform level, just sufficient to seal the pipe when the retort is at work. The disc can be raised or lowered most effectually by the use of a screw and wheel, with a pointer attached to show the lineal opening. On the moveable disc being lowered, the water from the hydraulic main will flow away, and the pressure will be removed from the retort to such an extent that the whole of the gas evolved can be drawn off by the exhauster at level gauge. *Patent abandoned.*

2994. M. Henry. *Improvements in the manufacture of soap, and the preparation of materials for the purpose* (A communication.) Dated Nov. 27, 1861.

This consists chiefly in treating materials intended for the manufacture of soap with acids—especially sulphuric acid—which attacks the glycerine of oil and fat, and renders it capable of combining with alkalies. *Patent completed.*

2995. W. Rowan. *Improvements in machines for heckling and scutching flax and other vegetable fibres.* Dated Nov. 27, 1861.

This invention consists in forming on, or in fixing to, the the ends of the beaters, and of the bars which carry the pins for heckling and the beaters (or combs) for scutching, spindles, or trunnions, which spindles are received in bearings fixed on the circular frame cylinder or drum of the machine. The invention also consists in fixing adjustable guards in front of the heckle pins when the machine is used for heckling, in order that the depth to which the pins enter the fibre may be regulated according to the nature thereof. While play is allowed to the beaters and heckle or comb-bars they are prevented from revolving. *Patent completed.*

2996. S. Amphlet. *An improvement or improvements in ornamenting surfaces.* Dated Nov. 27, 1861.

This consists in ornamenting surfaces by photographs of objects, from which photographs the background produced in taking the said photographs has been cut away, the photographs being mounted upon tartan or Scotch plaid patterns, or imitation tortoiseshell, these patterns forming the back ground. *Patent completed.*

2997. H. Wilde. *Improvements in magneto-electric telegraphs, and in apparatus connected therewith.* Dated Nov. 28, 1861.

The first part of this invention is not described apart from the drawings. The invention consists, 2, in certain improvements in the method of submerging uninsulated metallic cables, which greatly diminishes the risk and loss when by any accident such cables break in deep water, and cannot be recovered, and which method renders the cables less liable to injury after being submerged. The uninsulated cable to be submerged is divided throughout its entire length into a suitable number of longitudinal sections which form separate cables; each section is then separately submerged and the extremities of all the sections are collected together at each shore end, and joined so as to form one conducting cable. *Patent completed.*

2998. W. Cooke and F. Squire. *An improved construction of paddle-wheels for vessels propelled by steam or other motive power.* Dated Nov. 28, 1861.

This consists in so adjusting the floats that, instead of entering into and rising from the water at certain angles, they have a perpendicular action, and thus avoid the usual surge or back water. *Patent abandoned.*

2999. C. Stevens. *Improvements in furnaces for working iron ore.* (A communication.) Dated Nov. 28, 1861.

This invention is not described apart from the drawings. *Patent abandoned.*

3000. J. M. Rowan. *Improvements in the manufacture of railway wheels, and in apparatus to be used therein.* Dated Nov. 28, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3001. S. A. Carpenter. *An improvement or improvements in attaching name plates or labels to umbrellas, parasols, walking-sticks, and whips.* Dated Nov. 28, 1861.

This consists in attaching name plates or labels to umbrellas, parasols, walking-sticks and whips by means of a spring tubular clip; to which the name plate or label is affixed, the said clip being secured to the object by springing it thereon, as described. *Patent completed.*

3002. P. Spence. *Improvements in the treatment of ores for the manufacture of sulphuric acid, and in apparatus connected therewith, which apparatus is also applicable to the treatment of ores for separating metals therefrom.* Dated Nov. 28, 1861.

This invention relates to a previous patent, dated 3rd of June, 1861 (No. 1695), and consists, chiefly, in submitting iron pyrites, ores of lead, or of zinc, or other ores containing sulphur, to the action of heat in batches, which are successively moved on from one end of the furnace to the other, and in causing a current of air to pass over them. *Patent completed.*

3003. F. F. Weiss. *An improved fastening for boxes and cases.* Dated Nov. 28, 1861.

This improved fastening applies to all cases and boxes having lids or covers. It consists of one or more undercut studs fixed to the lid with button slots fixed to the case; or the studs may be fixed to the case and the slots to the lid; also of one or more sliding hinges applied to the case and lid. The hinges may be made without stops, so that the lid may be entirely removed from the case, or they may be made with stops, when the lid will turn upon them as upon ordinary hinges. *Patent abandoned.*

3004. W. A. V. Konig. *Improvements applicable to stoves or open fire-places for utilizing more of the heat therefrom than heretofore, also for economizing fuel and igniting the same.* Dated Nov. 28, 1861.

This consists in adapting to ordinary stoves or open fire-places the following parts, viz., in the back of the stove the inventor forms a hole, say, for example, three inches in diameter, into which he fits an elbow pipe, and connects thereto behind and at the back of the stove, an upright pipe, the top of which is open; around the upright pipe he places and fits another larger pipe, so as to leave space between the two pipes, and he forms branches right and left from the top of the larger pipe leading to gratings or openings at the front of the stove under the mantel shelf or over the same, and fitted with ventilators for opening and closing or regulating the passage of heated air at will. He also adapts a slide to the front of the pipe fixed in the back of the stove for the same purpose. At the bottom of the hearth of the fire-place he adapts a pipe for the admission of cold air into the space between the two vertical pipes, aforesaid, situate behind the back of the stove. *Patent abandoned.*

3005. J. D' A. de Laraune. *Improvements in machinery for cooling and freezing water and other fluids.* (A communication.) Dated Nov. 28, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3006. B. Pitt, and J. J. Sherlock. *Improvements in cocks or valves for the passage of fluids.* Dated Nov. 28, 1861.

Here a box or case is used having inlet and outlet passages at its ends. The valve works within this box or case, and it is preferred that the box or case in which the valve works should be of a square or rectangular section, and that the inlet and outlet passages at the two ends thereof should be of a circular section, but of less diameter than the ends of the box or case. Through one side of the box or case a spindle or axis passes into the interior of the box or case, a stuffing box being used to prevent the escape of the fluid around the axis. The inner end of the spindle or axis turns in a suitable bearing, and has fixed upon it an eccentric, or it may be a projection. The valve is fixed to the end of a frame which is supported by and slides on two ledges or guides on the interior of the box or case. The spindle or axis above named passes through the frame so that the cam or projection on it will, when the axis is turned in one direction, press the valve against its seat, and when the axis is turned on the opposite direction will move the valve away from its seat. *Patent completed.*

3007. E. Funnel. *A self-acting indicator signal for railways.* Dated Nov. 29, 1861.

This invention is not described in detail apart from the drawings. *Patent abandoned.*

3008. L. H. C. J. Cable. *Improvements in means or apparatus for indicating and registering the "score" for billiards and other games.* Dated Nov. 29, 1861.

The invention is not described apart from the drawings. *Patent completed.*

3009. T. Ellis. *Certain improvements in rails for permanent ways.* Dated Nov 29, 1861.

This consists in making the rail as regards transverse section of a peculiar form, the rail being made hollow, or what is termed a bridge rail, but rolled so that the base of each side of the rail will meet, or nearly so, in the vertical centre line or plane of the rail, thereby making a more solid bearing on the longitudinal timbers, the object being to prevent the sides of rail collapsing, a defect which the patentee in some cases obviates by introducing a flat bar of iron between the bridges of the rail. *Patent completed.*

3010. A. B. Childs. *Improvements in wringing machines.* (A communication.) Dated Nov. 29, 1861.

This consists of a pair of india-rubber rollers hung in a framework of galvanised malleable iron of a peculiar form. The pieces composing the frame are held together by a single rod or tie passing through them nearly in the centre, and forming a joint in the frame, by which the rolls are held in their proper place, and the machine clamps itself firmly to the tube or box. The rolls are held together by forcing the opposite ends of the frame in which they are placed apart by pressing them down on the edge of the tub or box, so that they are separated. On the ends of the frame opposite to the rolls are small buffers made of india-rubber or a spring equivalent. These buffers are held in their place by a small rivet, and allow the rolls to adjust themselves to the different thicknesses of clothes, which are passed between them, and they also fasten the machine to the tub. *Patent abandoned.*

3011. S. Tonks and J. Brookes. *Improvements in steam boiler furnaces, and in setting certain kinds of steam boilers.* Dated Nov. 29, 1861.

This consists in building steam-boiler furnaces with the fire-bars or fire-place in front of, or on the side of, the boiler, so that the fire of the furnace does not strike directly on the bottom of the boiler. Beyond the bars or fire-place is a wall or bridge, rising a short distance above the level of the said bars or fire-place, and still further protecting the boiler from the action of the fire. The furnace is covered in over the fire-place with an arched top. In setting such steam-boilers according to this invention, such steam-boilers as have large internal flues, the inventors build in the front ends of the said flues a lining of fire-brick, so as to defend the said fluids from the injurious action of the fire. *Patent abandoned.*

3012. R. C. Perry. *An improved infant's feeding bottle.* Dated Nov. 29, 1861.

This consists in the application to ordinary feeding bottles of a novel form of valve. The valve is made of caoutchouc or other elastic material, and is in the form of a short tube, one end of it being attached to the cock or stopper of the feeding bottle, the other end projecting a short distance into the bottle, and terminating in an orifice of about the same size as the outer diameter of the suction tube which passes through it; a perforation in the cock or stopper admits air to the interior of the valve, where the pressure caused by the withdrawal of the liquid contents of the bottle expands the opening at the extremity of the valve, and admits air to the interior of the bottle; but in the case of the bottle being reversed or overturned, the contents will not pass out. *Patent completed.*

3013. P. Tagliacozzo. *Improvements in lamps and utensils thereof.* Dated Nov. 29, 1861.

This invention consists in the following arrangements of parts:—The dome or cone apparatus of the burner, either with or without the chimney gage and globe supporter attached to it, will be made to open and shut by a hinge or similar plyer, instead of removing it. The fastening and unfastening of the same apparatus will be effected by catch, latch-spring, screw, or similar fastenings. The rack and pinion to raise and lower the wick will have a sharp-edged broad wheel, instead of the usual pointed or toothed wheel or wheels. The utensil for trimming the wick will be similar to a pair of small tongs, the nipping edges of which, being furnished with india-rubber or similar material, representing more or less the action of the fingers. *Patent abandoned.*

3014. R. A. Brooman. *An improved safety buffer or apparatus to be used in railway trains to prevent accidents from collisions.* (A communication.) Dated Nov. 29, 1861.

This invention consists of one or more air-tight cylinders fitted as hereafter described, mounted upon a truck or carriage to form a compressed air buffer. It is proposed that two trunks carrying the buffers should form part of every train, one in front and the other at the rear of the ordinary carriages, but more or less than two such trucks may be used. The cylinders are fitted with two pistons, the rods or trunks of which extend beyond the cylinders at each end, and carry buffer heads, and with one or more safety-valves to prevent explosion, and also to allow of the escape of compressed air after a given pressure has been attained, in order to prevent the rebound or forcing back of the pistons or either of them. Sometimes the inventor fixes a rail or rails in the bottom of the cylinders on which the pistons are supported on grooved wheels or pulleys, and he provides friction rollers for the piston rods to run on. *Patent abandoned.*

3015. E. Tyer. *Improvements in electric telegraphs.* Dated Nov. 29, 1861.

The specification of this invention is exceedingly elaborate, and cannot be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

2016. R. Cook and G. H. Spencer. *Improvements in the manufacture of umbrellas and parasols.* Dated Nov. 29, 1861.

According to one part of these improvements the "middle bit," as a separate piece, is done away with, and the hole for a pin as a connection for the stretchers is obtained by operating upon the rib at that part, so as to produce a slit or opening; and the inventors make a similar hole at the end of each rib. The improvements also relate to applying a shield extending over the circular groove or notch around the runners, and adapted to receive and enclose the ends of the ribs, the stretchers of which are formed longer for the purpose. By these means, the covering of the umbrella or parasol will be protected from wear at such part. And they apply a spring catch to hold the runner and shield in position. The improvements also relate to the application of india-rubber as a shield over the circular notch of the runner, and extending over parts of the stretchers, as also on the barrel of the runner, in order that, when the umbrella or parasol is shut, the ribs may be on the india-rubber, and thereby prevent the ribs from entering between the stretchers. *Patent abandoned.*

3017. W. Cooke. *A wind guard for curing smoky chimneys.* Dated Nov. 30, 1861.

This consists of an upright tube or shaft, of a size suitable to the chimney shaft, having at the top a cone, the side of which cone forms an angle of 45 degrees, with the base line, and placed so that the apex of the said cone is on a level with the top of the tube; the area of the base of the cone is of the same size as the area of the tube, such tube or shaft having surrounding it at the upper part a larger tube or outer casing, so fixed and of such size that an annular space is left between the outer tube and the inner tube and cone, equal in area to the area of the inner tube. The said outer tube is constructed of a tapering form, the area at top being equal to the area of the said tube or shaft. Another part of the invention consists in an arrangement of the outer and inner tube or tubes, as effectually allows the emission of the smoke without admitting a downward current of air. *Patent abandoned.*

3018. J. W. Gibson. *Improvements in ordnance, applicable also to small arms.* Dated Nov. 30, 1861.

This consists in substituting for any of the usual means heretofore employed for closing the breech-end of the bore a vent-piece or flat plug, slightly tapered to cause proper fitting and allow for wear, which vent-piece or plug is made to fit into a slot or opening, having parallel sides or grooves for its reception and guidance. *Patent abandoned.*

3019. J. Cooper and C. Garrood. *Improvements in cultivators, horse hoes, and horse rakes.* Dated Nov. 30, 1861.

For these purposes two or more axles carrying tines are mounted in a frame, and in order to fix the tines to the axis, each axis has a bar fixed parallel to and at a short distance from it. The stem or upper portion of each tine is placed against the axis and its bar, and is secured thereto by a strap, (through which the stem or upper part of the tine passes) and a key or wedge is driven through the strap on the side of the axle and bar opposite to that against which the tine is held. The axes are geared together so that, on one of the axes being turned, the other axis or axes and tines are similarly acted on; this is done by gearing them with cog-wheels. For turning the axes when required, a lever or handle is used. *Patent abandoned.*

3020. E. Pater. *Improvements in collars for gentlemen's, ladies', and children's wear.* Dated Nov. 30, 1861.

This consists in the insertion of one or other number of gussets of a thin material into the bands of collars. *Patent abandoned.*

3021. A. Schultz. *Improvements in the manufacture of certain colours for printing and dyeing fabrics.* Dated Dec. 2, 1861.

This consists in the use of a decoction of logwood, combined with caustic soda, for producing different shades of black, chocolate, olive, &c., upon cotton, wool, silk, and other fabrics. *Patent abandoned.*

3022. J. Wakenell. *Improvements in the construction of invalid bedsteads, convertible into other articles of furniture for the use of invalids.* Dated Dec. 2, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3023. W. P. Bain. *Improvements in protecting ships' bottoms from fouling.* Dated Dec. 2, 1861.

This invention consists in cementing canvas or other textile fabric to the bottoms of ships, using asphalte by preference for the cement. After a ship has been sufficiently long at sea for her bottom to become foul, the inventor strips off the canvas, which will carry with it all the animalculæ and other matters which usually foul the bottoms of ships. The invention further consists in paying over ships' bottoms with asphalte, or other bitumenous or adhesive composition in which zinc or copper filings or both have been mixed or incorporated. *Patent abandoned.*

3024. G. Ralston. *Improvements in the mode of preparing and applying a certain material on the hulls of iron or wooden ships, or on the surfaces of materials for building the same, also for preventing oxidation and tubercles in iron water pipes.* (A communication.) Dated Dec. 2, 1861.

Here the patentee, 1, takes armorphose graphite, and reduces it to fine powder, and frees it as much as possible from impurities. The powdered graphite is then mixed with oil as follows:—The mixer is slightly warmed by a coil of pipe heated by steam, so that the powdered graphite shall not be allowed to cool and take up atmospheric moisture. Then pure crude or raw linseed oil is put therein, in proportion of one pound of oil to three pounds of the dry powdered graphite, and when these have been gradually mixed or combined in the mixer, there must be added hot pure yellow beeswax, in the proportion of about one pound of beeswax to every ten pounds of the powdered graphite; the whole must be thoroughly incorporated previous to being ground cold. *Patent completed.*

3025. T. W. G. Treeby. *Improvements in machines for boring holes in rocks and other hard substances.* Dated Dec. 3, 1861.

This consists of a drill or boring tool which is fastened to a striking rod, which rod moves in iron or wood framing. On this striking rod there is fastened a serrated disc or face ratchet, and on this striking rod there is also attached a spring that gives the blow to the boring tool. The boring tool is withdrawn by a cam or lug working on a spindle; the cam or lug on the spindle rotating, strikes against the serrated disc or face ratchet on the striking rod, pressing the spring back; as soon as the cam or lug passes the centre, the striking rod is instantly released, and the blow is given by means of the spring before named. *Patent completed.*

3027. A. M. A. Pichery, and P. L. Damais. *Improvements in hermetically stopping or covering jars, pots, vases, and other like articles.* Dated Dec. 3, 1861.

The inventors propose, 1, to polish with emery the rim of the pot or vase, and also the edge of its cover, to form a circular throat or groove surrounding exteriorly the mouth of the pot or vase, and a similar groove on the cover, which two grooves will materially assist the soldering with mastic, by which the pot or vase is to be hermetically closed. The circular cover or lid, as well as its upper medium, will present a square bottom larger at top than at bottom, which, with the arrangements of the inner throat of the pot or vase, will assist in the perfect retention of the mastic. *Patent abandoned.*

3028. J. H. Glew. *Improvements in machinery or apparatus for sewing or stitching.* Dated Dec. 3, 1861.

This consists in the use of two shuttles in machinery or apparatus for sewing or stitching instead of one, as heretofore, by which the inventor is enabled to use two needles. *Patent abandoned.*

3029. J. Burrows and J. Dougan. *Certain improvements in winding or driving drums or pulleys.* Dated Dec. 3, 1861.

This consists, 1, in the application of power or pressure to some part or parts of the rope, band, or chain during the time in which such parts or portions of the rope remain in contact with the drum or pulley, by which the patentees obtain an increased amount of adhesion, and a correspondingly greater power for driving machinery, drawing or lifting weights, and similar purposes. 2. In arranging the sides or planes of winding drums, sheaves or pulleys parallel to each other, leaving a space between the insides of the planes of each drum, sheave, or pulley, equal to, or only a little in excess of, the diameter of the rope to be used, so that when the rope is attached to the drum, and the drum is caused to rotate, each consecutive coil will be wound or laid upon the preceding coil, and so on in succession. *Patent completed.*

3030. J. Leach. *Improvements in preparing matters to be used in the manufacture of candles.* Dated Dec. 3, 1861.

This consists in producing or manufacturing a substance suitable for making candles, by subjecting dead or heavy oil to the action of chlorine gas, distillations, and carbonic acid gas. *Patent completed*

3031. G. T. Bousfield. *An improved stopper for bottles, decanters, jars, and similar articles.* (A communication.) Dated Dec. 3, 1861.

This consists in the manufacture of a hollow stopper of elastic gum, havine shoulders adapted to corresponding shoulders on the neck of the bottle. *Patent completed.*

3032. J. S. Field. *Improvements in the manufacture of mould candles.* Dated Dec. 3, 1861.

This consists in the lower end of each candle being moulded with a tapering end, so that the end may diminish more and more towards the end which enters the socket of a candlestick. *Patent completed.*

3033. W. Duchemin. *Improvements in blocks for hoisting.* Dated Dec. 3, 1861.

This relates to that class of hoisting blocks in which friction rolls are introduced, and consists, 1, in a block having a ring or central bearing of considerable diameter, cast on to, or otherwise suitably attached to, the shell of the block, and surrounded by a loose metal ring (which serves the purpose of the sheave of an ordinary block), and between which and the central bearing is interposed a series of friction rolls, on which the loose ring turns. 2. In metal bushings for sheaves of blocks, the same consisting of a loose ring or sleeve surrounding the axle on which the sheave runs, a series of friction rolls, and a box for containing the same. *Patent completed.*

3034. W. E. Newton. *Improvements in artificial teeth.* (A communication.) Dated Dec. 3, 1861.

The patentee claims the manufacture of mineral teeth with pins having heads at their outer ends, as and for the purposes set forth. *Patent completed.*

3035. W. E. Gedge. *Improvements in the manufacture of nose bags and similar articles, and in apparatus connected with such manufacture.* (A communication.) Dated Dec. 4, 1861.

This relates to the manufacture of canvas, &c., for horses' nose bags, such canvas presenting one or more open worked or trellis parts, obtained by the insertion in the tissue, by and during the weaving of the same, of a suitable number of strings, twine, or other thread, of a much coarser description than those of the remainder, back, or ground of the tissue, the said strings, twine, or coarser threads, forming by their mutual interweaving a coarse open worked part or trellis. *Patent completed.*

3036. J. Hemingway. *Improvements in the manufacture and ornamentation of textile fabrics.* Dated Dec. 4, 1861.

The patentee claims, 1, the combination or admixture of the feathers or parts of feathers (or down), or both, of birds, with or in textile fabrics, as described, the feathers being raised on the surface so as to form a pile or down. 2. The combination or admixture of the short hair or fur of animals with or in textile fabrics, such short hair or fur being raised so as to form a pile or nap, as described. 3. The ornamentation of textile fabrics by the combination or the admixture therewith in figures or ornamental designs (on a plain ground) of such feathers or parts of feathers, down, hair, or fur, either separately or combined, as described. 4. The ornamentation of textile fabrics by the application thereto or insertion therein of the whole or parts of the skins of animals, birds, insects, reptiles, or fishes, as described. 5. The ornamentation of such fabrics by the insertion or introduction therein or application thereto of artificial imitations of birds, beasts, &c., as described. *Patent completeld.*

3037. T. Stead, and W. Higham. *Improvements in machinery or apparatus for spinning cotton or fibrous materials.* Dated Dec. 4, 1861.

This relates to the hand and self-acting mule, and consists in placing an additional roller, covered with cloth or flannel, a short distance below the under clearer roller, and causing it to revolve in an opposite direction to the clearer roller, for the purpose of preventing hard threads from beiog mixed with the waste during the process of spinning. *Patent completed.*

3038. C. Crabtree. *Improvements in paper tubes and in the means or machinery for making or manufacturing the same.* Dated Dec. 4, 1861.

Here the inventor cuts off the outer corners of the laps (which through not being properly pasted down, project out and catch on the yarn or weft and break it), before rolling the paper into tubes. The apparatus for this purpose consists of a table with adjustable guides or fences for setting or guiding a number or quantity of the sheets of paper into proper position, so that a knife, or knives, or cutting instruments, of suitable shape, mounted in slide frames, and to which reciprocating motion is given by hand or power, will cut off the said corners to the precise form and size required with great facility. *Patent abandoned.*

3039. J. E. Boyd. *Improvements in scythes, scythe-handles, and apparatus for connecting the same.* Dated Dec. 4, 1861.

This consists in making the scythe handles of iron or other metal pipes or tubing. The aperture on the end of the metal tube or handle will be so constructed as to form a case, or socket, or receiver, and made capable of fitting, regulating, and holding therein the tang or heel of the scythe. *Patent abandoned.*

3040. H. G. Hacker. *Improvements in machinery for the manufacture of chenille and other circular pile fabrics.* Dated Dec., 4., 1861.

This consists in winding and lapping, by means of a suitable flyer, the material for forming the pile of the chenille or other circular pile, round a frame of metal of a width corresponding with the number of pieces of chenille, &c., required to be made at one time. The side or sides of this frame is or are inclined to such an extent as to allow the pile material, already wound on, to slip freely along it when a slight impulse is imparted to it. When this material arrives at the narrowest part of the frame, it is nipped between a pair of revolving rollers, which draw the material off the frame as it is wound on. These rollers have circular grooves at distances corresponding with the width of the chenille, or other circular pile fabrics required to be made; these grooves serve as guides to conduct the material for forming the body of the chenille or other circular pile fabric, in the centre above and below the pile material. The rollers have also deeper circular grooves in which the cutting edges for severing the pile material are placed, which cutting edges may have a reciprocating or other suitable motion. Bobbins containing the material for forming the body of the chenille, or other circular pile fabric, are placed in any convenient position, the material being connected by guides to its proper position above and below the pile material. These materials pass through the grooved rollers, and when the pile material arrives at the centre between the same, where it is held by the pressure upon the rollers, it comes in contact with the cutting edges which sever it into strips, and, as the rollers revolve, these strips, together with the bodies which lie down the centre above and below each strip, pass out, and the ends of each are connected to suitable spinning apparatus, which is caused to travel away from the rollers as fast as the material is delivered from them, and which twists the same respectively into separate pieces of chenille, or other circular pile fabrics. At the place where the pile material is bent round the side of the tapering frame, it is cut open by circular or other suitable cutting edges, so that no waste occurs in the process. *Patent completed.*

3041. W. E. Newton. *Improvements in pumps.* (A communication.) Dated Dec. 4, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3042. R. Kennedy and J. Armstrong. *An improved arrangement of driving gear.* Dated Dec. 4, 1861.

The object here is the prevention of "back-lash," and this object is effected by applying to the spindles of the bevil or spur gearing fast pulleys, around which run driving straps, which run from one pulley to another. *Patent completed.*

3043. W. H. Balmain. *Improvements in the manufacture of potash and salts of potash.* Dated Dec. 4, 1861.

This consists in the use of the spent bark, or other woody fibre from which tanning or colouring matter has been extracted, as a source of potash and its salts. *Patent completed.*

3044. R. A. Brooman. *Improvements in albums or books for containing and showing photographic and other pictures, and in slides for the same.* (A communication.) Dated Dec. 4, 1861.

The patentee takes two of such sheets of paper with apertures in the centre as are generally used in albums for showing photographic pictures, and unites them at three sides after having interposed a strip or strips of thick paper, carboard, or the like, equal or nearly so to the thickness of two of the pictures to be contained and shown. Thus the sheets will be united at their edges on three sides to interposed filling pieces, and one side will be left open for the insertion of the slide hereafter described. The slides consist of a frame of cardboard or thick paper equal in thickness to the interposed filling pieces. To one edge of the frame on both sides a sheet of gelatine, talc, or other transparent material is attached; the space left in the frame is calculated to receive two pictures back to back. After being inserted in the space in the frame, each picture is entirely covered by the gelatine or talc. The slide is formed with angle pieces, and when inserted between the sheets of paper the outer edge of the slide fills up the space between the unclosed edges of the two sheets. *Patent completed.*

3045. A. Pullan, and W. Lake. *Improvements in traction and other engines, and in wheels for traction engines and other carriages, and in giving motion to ploughs and other agricultural machines.* Dated Dec. 4, 1861.

This relates, 1, to means for preventing the communication of the driving wheels to the parts of the engine generally. 2. To means for keeping the pinion or the driving shaft in connection with the teeth on or giving motion to the driving wheel. 3. To a previous patent (No. 1670, year 1859), and consists in obtaining increased width of bearing surface to the bearing wheels by an additional wheel, which is brought into position when required, and which when not in use will remain stationary, and in coming into and going out of action will move in a vertical direction. 4. To preventing the slipping of the wheels of traction engines. 5. To applying teeth or grippers to the metal surface or tyre of wheels upon wood felloes, such tyres projecting on each side beyond the felloes to facilitate the affixing of fresh teeth or grippers when required. 6. To the bearing wheels of traction engines and other carriages when supplemental rails or shoes are employed in connection therewith. 7. To the application of teeth on axes, and moving on the side surfaces of driving wheels, such teeth being connected together by links, and worked by a rod or rods from an excentric on the driving shaft. 8. To communicating motion to the driving wheels of traction engines by an endless band or endless bands of wire rope aided by clip sheaves or drums. 9. To the use of wire ropes with projections formed thereon to run upon wheels the surfaces of which are provided with holes or recesses for the projections to work in. 10. To means of giving motion to the main wheels of traction engines. *Patent abandoned.*

3046. C. S. H. Hartog. *Improvements in the preparation and treatment of vegetable fibres, the better to adapt them for combining, working up, and dyeing with different fibres, such as silk, wool, cotton, and others, and in apparatus used in such treatment or preparation.* Dated Dec. 4, 1861.

This consists, 1, in preparing vegetable fibres of a silky and woolly nature, suitable for admixing, spinning, and working up with animal wool and hair, &c. 2. In the use of these products in spinning and manufacturing all kinds of yarns and woven fabrics, &c. 3. In the use of such chemical agents and such mechanical apparatus as will entirely remove all resinous, ligneous, and other matters from such vegetable fibres, so as to cleanse and bleach them and prepare them to take perfectly dyes of all colours, and with any admixture of wool, &c. *Patent completed.*

3047. A. T. Carr. *The application of a material to the shoes on horses' feet for the purpose of preventing their feet from slipping.* Dated Dec. 5, 1861.

Here the inventor takes a fibrous material and makes a layer of it of the shape of a horse's shoe, and applies this layer to the ground or wearing surface of a shoe, and secures the layer in that position by wires passing round both the shoe and the whole or a portion of the layer of material in several places. The shoe is formed with transverse recesses across that surface of it which is placed in contact with the horse's foot, through which the wires for securing a layer of material to the shoe may be passed. *Patent abandoned.*

3048. J. Knowelden. *Improvements in pumps.* Dated Dec. 5, 1861.

The first part of this invention is for an improvement upon an invention, for which letters patent were granted to the present patentee, in conjunction with Downes Edwards, 7th July, 1859, No. 1613, and refers to the valve chamber and valves. The present improvement consists in forming the chamber circular, and in fitting the valves to feathers on a circular plug. The patentee connects a handle to the outside of the plug, whereby the same may be withdrawn in case of need, and whereby the action of the pumps in connection with the valves may be reversed, that is, the pipe which acted as a suction pipe, may be made to act as a force or delivery pipe, and that which acted as a force may be converted into a suction pipe. *Patent completed.*

3049. G. W. Robertson. *Improvements in machinery for cleaning rice and other grain.* Dated Dec. 5, 1861.

This invention consists in forming a conical basin of stone, and in fitting so as to revolve between the sides thereof a conical drum, of such size as to allow of space between the basin and drum all round. The inventor covers this drum with sheepskin, felt, or other like yielding and soft material. He forms apertures in the sides of the basin, and inserts wire gauze for the purpose of admitting air, and to allow of the debris and dirt from the grain passing through the same. Rotary motion is imparted to the drum, the grain is fed in between the drum and the basin, and the grain in passing through the machine becomes cleansed. *Patent abandoned.*

3050. J. Wilson. *Improvements in frames used for displaying trade show cards, pictures, or other similar devices.* Dated Dec. 5, 1861.

Here, in order to identify each frame with the house of business from which it was issued, the inventor attaches the trade mark or device to the frame, so as to render it useless for any other purpose. *Patent abandoned.*

3051. W. Pirie. *Improvements in pumps.* Dated Dec. 5, 1861.

This relates to certain peculiar constructions and arrangements of combined lift and force pumps, whereby the first cost is considerably reduced, the working parts being greatly simplified, and comprises much detail which we cannot produce here. *Patent abandoned.*

3052. J. Cochrane. *Improvements in wet gas meters.* Dated Dec. 5, 1861.

Here it is proposed to surround the present float of the gas inlet valve by a box or partition, so as to separate it from the ordinary water chamber of the meter, and to insert the lower end of the water supply pipe into this box or float chamber, in lieu of into the main water chamber, as heretofore. By this means the smallest quantity of water which may have been fraudulently extracted by a syphon or otherwise through the water supply pipe will instantly affect the position of the float, and cause the gas to be shut off without affecting the proper water level in the measuring chamber. *Patent completed.*

3053. W. Busby. *Improvements in ploughs.* Dated Dec. 5, 1861.

This is designed to obviate the necessity for shifting the mould board of ploughs. This the inventor proposes to effect by using two plough boards, or plates of metal of the shape of a plough board fixed together, and projecting each side of the shoe of the plough, to which they are hinged in front; the opposite ends of the plough boards or metal plates are connected together by a cross piece of metal, into which one end of a lever rod takes, the fulcrum of the said lever rod being upon a pin connected to a cross piece of metal fixed to the handles of the plough. He also connects another lever to the first-named lever for moving the coulter from side to side. *Patent abandoned.*

3054. C. Davis. *An improved composition for coating metal and wood to preserve them from decay, applicable as a substitute for copper and other sheathing or other compositions now in use for coating ships' bottoms to protect them from the injurious action of water.* Dated Dec. 5, 1861.

This consists in mixing or compounding the following ingredients:—Coarse brown soap, pitch, spirits of turpentine, and elastic glue, in the proportions of about a quarter of a pound of soap to six pounds of pitch, one pint of spirits of turpentine, and one quarter of a pound of elastic glue. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Feb. 25, 1862.

508. C. W. Heckethorn, St. Ann's-road, Brixton. Improvements in obtaining and applying motive power by means of a wheel containing mercury.

Dated March 7, 1862.

611. J. Carpendale, Britannia metal smith, and T. Middleton, table blade grinder, Sheffield. Improvements in means of producing raised chasing on copper, silver, and Britannia-metal, by application of pressure.

Dated April 9, 1862.

1013. J. Jones, jun., Ship-yard, Sefton-street, Liverpool. Improvements in constructing and arming ships and vessels.

Dated April 15, 1862.

1084. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in the manufacture of blasting powder. (A communication.)

Dated April 25, 1862.

1223. E. A. L. Negretti and J. W. Zambra, Hatton-garden, meteorological instrument makers. Improvements in the construction of mercurial minimum thermometers.

Dated April 26, 1862.

1238. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in the manufacture of hollow glass ware. (A communication.)

Dated April 29, 1862.

1251. E. Clark, 24 Great George-street, Westminster, C.E. Improvements in arches. (A communication.)

1257. D. M. Childs, 481 New Oxford-street, engineer. Improvements in steam engines. (A communication.)

1258. D. M. Childs, 481 New Oxford-street, engineer. Improvements in reaping and mowing machines. (A communication.)

1259. D. M. Childs, 481 New Oxford-street, engineer, Improvements in the means of changing a rotary into a reciprocating, and a reciprocating into a rotary movement in machinery. (A communication.)

Dated May 7, 1862.

1361. T. Markland, Hyde, Cheshire, expansive reed maker. Certain improvements in wearing apparel.

Dated May 8, 1862.

1376. W. Riddle, Gerrard-street, Islington. Improvements in hydraulic and other presses, and apparatus used therewith, adapted to packing cotton and other fibrous substances.

Dated May 10, 1862.

1412. J. B. Cristofini, Paris. Improvements in tents.

Dated May 15, 1862.

1463. T. H. Le Mesurier, Saint Peter's-port, Guernsey, master plumber and machinist. Improvements in raising sunken vessels and other heavy bodies.

1465. R. Walsham and J. Walsham, Birmingham, stampers and piercers. A new or improved sleeve tie or fastener.

1467. J. Dicker, Hendon, supervisor of mail bag apparatus. Improvements in apparatus for the delivery of bags or parcels from railway trains in motion.

1469. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane, engineer. Improvements in apparatus for consuming smoke. (A communication.)

1473. C. Attwood, Tow Law Iron Works, Durham, iron master. Improvements in the production or manufacture of steel and iron of a steely quality.

1475. I. Baggs, Cambridge terrace, chemist and engineer, and W. Simpson, Tovil Upper Mills, Maidstone, paper maker. Improvements in treating straw, Spanish grass, and other vegetable fibres, in preparing a bleaching agent for vegetable fibres, and in recovering and treating an alkali resulting from the treatment of the said fibres, and in apparatuses employed therein.

1477. A. Watney, 35 Upper Berkeley-street, Portman-square. Improvements in the construction of ships, vessels, and other structures intended to resist shot.

Dated May 16, 1862.

1479. J. Railton, St. Paul's Foundry, Blackburn, and T. Railton, mechanic. Improvements in warping machines.

1481. R. Fenner, 7 Red Lion-court, Fleet-street, envelope maker. Improved machinery for folding envelopes.

1482. R. Laming, 38 Priory-road, Kilburn. Improvements in constructing and using electric telegraphs.

1483. C. Binks, Parliament-street, Westminster. Improved methods of and apparatus for treating linseed and other oils and fats.

1485. A. L. Thirion, Aisch-en-Refail, Belgium, gentleman. Improvements in the construction of railway and other carriages.

1487. D. C. Le Souef, Twickenham. Improvements in embossing metal plates. (A communication.)

1489. S. Peberdy, Philadelphia, U.S. Improvements in apparatus for knitting ribbed fabrics.

1491. N. Thompson, 15 Abbey-gardens, St. John's-wood. Improvements in stoppers or covers suitable for closing bottles, jars, and other similar vessels.

1493. B. Sharpe, Hanwell-park. Improvements in the construction of ships and vessels, and in masts and spars for the same.

1495. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved machinery, applicable to the cutting out of boot and shoe soles, and kindred operations. (A communication.)

Dated May 17, 1862.

1499. E. Tailbouis, merchant, 2 Rue Sainte Appoline, Paris. Improvements in rectilineal knitting frames.

1501. J. Broadley, Saltaire, York, overlooker. Improvements in means or apparatus employed in weaving.

1503. J. Needham, Piccadilly, gunmaker. Improvements in sheathing or coating iron ships.

1507. J. C. Gore, Jamaica-plain, U.S. Improvements in belt shippers.

Dated May 19, 1862.

1509. J. Eastwood, Blackburn, machine maker. Improvements in machinery or apparatus for removing and wringing hanks of thread or yarns, and all kinds of fabrics when saturated with liquid.

1511. G. Macdonald, Puttorghatta Colganny, Bengal, East Indies. Improved apparatus for ginning cotton, and for cleaning and preparing fibrous substances, also applicable for cleaning or polishing metal or other substances.

1513. W. Pickstone, Radcliffe, and T. Mellodew, Oldham. An improved fabric in the nature of a cord or corduroy.

1515. T. Morris, R. Weare, and E. H. C. Monckton, 4 Trafalgar-square. Improvements in the means and apparatus for the protection of life and property by the agency of electricity.

Dated May 20, 1862.

1519. M. A. F. Mennons, 24 Rue de Mont Thabor, Paris. Improvements in the method of and apparatus for applying screw power to the locomotion of railway trains on steep inclines. (A communication.)

1521. W. Naylor, Queen's-road, Dalston, engineer. Improvements in forging metals and in power hammers employed therein.

1522. R. Tallerman and L. A. Tallerman, 131 Bishopsgate-street Without. An improved method of protecting ladies' and and children's boots and shoes.

1523. J. Taylor, 13 Fenchurch-buildings, Fenchurch-street. Improvements in abstracting heat from liquids and aeriform fluids, and in apparatus employed therein, and for other purposes.

1525. E. Pewtrell, Birmingham, engine-fitter. Improvements in the manufacture of metal tubes, and in machinery to be employed for that purpose.

1527. J. Kennedy, Whitehaven, Cumberland, shipbuilder. Improvements in ship propellers.

Dated May 21, 1862.

1529. H. B. Barlow, Manchester. Improvements in presses for cotton and other substances. (A communication.)

1531. J. Kennedy, Whitehaven, Cumberland, shipbuilder. Improvements in plates for plating and for forming the outside skin of ships and vessels, and in protecting the same from fouling and oxidation.

1533. M. A. Le B. Virloy, Rue Pigalle, No. 9, Paris, C.E. Improvements in drying and carbonizing wood, peat, and other fuel.

1535. A. Giles, 9 Adelphi-terrace, Strand, C.E. Improvements in constructing floating breakwaters.

1537. H. C. Meyer, Ashford-street, Hoxton, engineer. Improvements in the means of stopping or retarding railway and other carriages.

Dated May 22, 1862.

1539. J. Oxley, King's-cross Wheel Works, Old St. Pancras-road, carriage-builder. Improvements in making wheels, and in the machinery to be employed therein.

Dated May 23, 1862.

1556. C. De Bergue, Strangeway's Works, Manchester, engineer. Improvements in machinery or apparatus for the manufacture of metal reeds for weaving.

1558. J. Webster, Birmingham, engineer. Improvements in coating and indurating metals.

1560. E. Mouline, Vals, France, silk merchant. Improvements in apparatus used in weaving.

Dated May 26, 1862.

1564. G. T. Livesey, South Metropolitan Gas Works, Old Kent-road. Improvements in purifying illuminating gas, and in treating the products obtained in the various processes of purification.

1566. W. and J. Harrison, Blackburn, machine makers, J. Oddie, and W. Parkinson, foremen. Certain improvements in machinery for winding, sizing, and weaving.

1570. J. Taylor, Oldham, cotton spinner. Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

1576. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improved means for superheating steam.

1578. J. E. Holmes, New York, U.S., civil and mechanical engineer. Improvements in machinery for digging or cultivating land. (A communication.)

1580. T. D. T. Sparrow, Piccadilly, brush maker. An arrangement or arrangements for shading street lights, in order to protect or shade the eyes of riders and foot passengers from the dazzling effect of the flames of such lights.

Dated May 27, 1862.

1584. J. Halliday, Manchester, warehouseman. Improvements in the manufacture of ornamental trimmings.

1586. H. D. P. Cunningham, Bury-house, Hants, esquire. Improvements in anchors.

1592. W. Palmer, New York, U.S. Improvements in revolving fire arms.

1594. G. H. Daw, Threadneedle-street, gun maker. Improvements in fire-arms.

Dated May 28, 1862.

1596. H. Eaton, Manchester, smith and wheelwright. Improvements applicable to presses for baling purposes.

1598. J. Simpson, Hulme, pattern frame maker. Improvements in machinery or apparatus for cutting or producing "mouldings" upon surfaces of wood or other suitable material.

1600. C. Cohen, 18 Bury-street, stick manufacturer. Improvements in walking, umbrella, and other like sticks.

1602. R. Martindale, Birmingham, lamp manufacturer. Improvements in the manufacture of globes and glasses, more particularly applicable to hydrocarbon and spirit lamps, and also in fastenings for securing the globes or glasses in those and other descriptions of lamps.

1604. H. Saunders and J. R. Mills, Birmingham, brass founders. Improvements in the manufacture of Venetian blinds, and other window blinds, and in apparatus for raising and lowering the same.

1606. R. A. Brooman, 166 Fleet-street, patent agent. Improvements in circular looms or machinery for the manufacture of looped or knitted fabrics. (A communication.)

Dated May 29, 1862.

1610. J. Critchley, Manchester, manager. An improved rib fastener for umbrellas and parasols.

1614. G. Ashton, Heywood, dyer. Improvements in dyeing fibrous substances, and in the means or apparatus employed for that purpose.

1616. W. Perks, Birmingham, glass and lead merchant. An improvement or improvements in metallic sash bars or windows, skylights, hothouses, and other like purposes.

1618. R. Griffiths, 69 Mornington-road, Regent's-park, engineer. Improvements in marine propellers for ships and boats, and for the sheathing of iron ships with metal sheathing to keep them from fouling.

1622. S. Minton, Woodlands-grove, Isleworth, engineer. An improved construction of revolving battery.

Dated May 30, 1862.

1624. F. Datichy and E. Sabatier, Mortimer-street, Cavendish-square. Improved machinery and process for making pulp for the manufacture of paper and other purposes.

1630. C. O. Staunton, Paulton-square, Chelsea. Improvements in apparatus for signalling and indicating the position of shots on targets in rifle practice, and for preventing accidents to the markers.

1632. R. C. Steed, Aylesford-street, St. George's-square, Pimlico, gentleman. Improved apparatus for signalling on railways.

1634. W. Eddington, Jun., Chelmsford, engineer. Improvements in apparatus for draining and tilling land.

1636. J. Ives, New York, U.S., merchant. Improved machinery for washing or wringing clothes or fabrics.

Dated May 31, 1862.

1638. J. H. Hollsod, Lorrimore-road. An improvement in traction engines.

1641. D. A. Lamb, Berwick-upon-Tweed. Improvements in railway buffers or apparatus to relieve concussions on railways.

1652. W. K. Sullivan, Upper Leeson-street, Rathmines, Dublin. Improvements in the preservation of stone, plaster, cement, and other like matters, the invention being likewise applicable to the manufacture of artificial stone, and to the fixation and production of colours on and in the body of stone, plaster, or cement.

Dated June 2, 1862.

1651. B. Templar, Manchester, schoolmaster. Improvements in apparatus for registering and indicating billiards and other games.

1566. J. Elce, Manchester, machine maker, and W. J. Gradwell, mechanic. Certain improvements in machinery for spinning, doubling, and winding cotton and other fibrous substances.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

1709. W. Harding, Aldersgate-street. Improvements in the manufacture of bonnet fronts, and in apparatus to be employed therein. Dated June 7, 1861.

1712. G. Haseltine, 100 Fleet-street, American barrister. A new and improved photographic camera. (A communication.) Dated June 7, 1861.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

313. R. Russell. Stove grates and kitchen ranges.

315. P. H. Astley and C. Leighton. Life boats.

324. P. Shaw. Lamps.

325. H. A. Silver. Manufacture of articles in ebonite, vulcanite, or other hard india-rubber.

335. F. Tolhausen. Tyres of railway wheels. (A communication.)

337. J. Carrington. Stalls and horse boxes.

347. W. Clark. Reflectors. (A communication.)

351. T. Fyfe. Knapsacks.

356. W. Wood. Manufacturing pomfret or liquorice cakes.

358. J. Brinsmead. Pianofortes.

359. R. Johnson. Welded wires.

360. G. Lindemann. Applying gas for the purpose of singeing, or dressing yarns or threads.

363. J. Hetherington. Preparing fibrous materials for spinning.

365. F. Tolhausen. Vertical steam boilers. (A communication.)

369. A. Hinshaw. Hooped skirts. (A communication.)

370. R. A. Brooman. Preparing and ornamenting cast iron and other metals. (A communication.)

371. J. S. Joseph. Coke ovens.

374. T. Horsley, jun. Breech loading fire-arms.

376. J. S. Joseph. Retort oven.

383. C. D. Abel. Towing boats. (A communication.)

384. T. Davison. Preventing the corroding of steam boilers.

390. E. E. Allen. Steam engines.

400. J. H. Johnson. Propelling ships and boats. (A communication.)

410. J. Cooke. Propelling ships and other vessels.

419. H. Crawford, J. Crawford, R. Crawford, and R. Templeton. Looms for weaving.

420. J. Hodgkinson and D. Greenhalgh. Preparing or combing cotton, wool, and other fibrous materials.

436. J. T. and O. Pendlebury. Doubling, folding or plaiting cloth.

439. F. Barnett. Lamp.

463. W. Hamer. Preparation of cotton.

470. W. Ashton. Manufacture of braids.

492. T. N. Kirkham and V. F. Ensom. Bleaching and dyeing.

498. W. E. Newton. Permanent way. (A communication.)

519. G. Rees. Marine subways.

545. W. H. Muntz. Paddle wheels.

717. W. McAdam. Manufacture of blocks, pulleys, and weights.

771. J. Cumming. Distributing and setting up type.

773. B. Samuelson. Chain harrows.

872. J. Bouchee. Rifled ordnance.

873. Y. Parfrey. Breech-loading fire-arms.

896. R. Burley. Forming or lining the bearings of axles and shafts.

922. W. C. Harrison and H. J. Standly. Tool for boring or drilling holes in slate or other rock.

937. L. Lindley and F. Taylor. Sewing and embroidering machines.

1182. A. Robertson and R. Barter. Distributing and projecting fluids.

1238. A. V. Newton. Manufacture of hollow glass ware. (A communication.)

1247. J. W. and F. G. Caley. Textile fabric.

1290. E. B. Wilson. Manufacture of malleable iron and steel.

1328. H. Allman. Construction of locks.

1334. J. Victor, J. Polglase, and W. Rounsevell. Safety fuses.

1339. E. B. Wilson. Manufacture of malleable iron and steel.

1486. F. B. Anderson. Watches and other time keepers.

1491. N. Thompson. Stoppers or covers suitable for closing bottles.

1592. W. Palmer. Revolving fire-arms.

1602. R. Martindale. Manufacture of globes and glasses.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated June 11, 1862.

3106. R. A. Brooman.
3111. R. Searle.
3114. W. W. Godfrey.
3119. J. W. Scott.
3123. S. B. Hewett.
3126. H. J. Olding.
3130. T. Walker.
3131. T. B. Gibson.
3136. J. Hetherington, T. Webb, and J. Craig.
3140. R. A. Brooman.
3141. R. A. Brooman.
3143. J. E. Dnyck.
3148. W. Husband.
3151. J. Willis.
3158. C. Baumann.
3165. J. Platt and W. Richardson.
3179. C. Pontifex.
3233. W. Hawksworth.
177. J. C. Johnson.
199. J. Wright.

Dated June 13, 1862.

3152. G. P. Vallas.
3154. W. Bartram and W. S. Harwood.
3155. D. Chalmers.
3156. J. Aitken.
3157. W. G. Lows.
3159. W. H. Tucker.
3163. J. Dale.
3166. R. Scott.
3173. J. Piddington.
3177. J. M. H. A. Taurines.
3178. J. Bannehr.
3180. W. Betts.
3183. E. Stott.
3184. J. H. G. Wells.
3206. W. Bennetts.
3223. E. B. Sampson.
3226. J. Cochrane.
3250. A. Warner.
82. H. Charlton.
106. W. Gorse.
387. R. Hornsby.
412. R. Bunting.
478. J. P. D. Camp.
584. F. B. Houghton.
599. J. Chubb and H. M. Burton.
737. W. Barber.
1101. J. Mackay.

Dated June 17, 1862.

3190. O. C. Evans.
3193. G. Walkland.
3194. W. Tipple.
3199. E. E. Pereau.
3200. R. Walles.
3203. D. C. Le Souef.
3207. F. Grimaldi.
3211. P. Selby.
3212. W. Kempe.
3220. J. F. Harvey.
3213. T. Bright.
3258. J. B. Payne.
26. F. S. Belloche and H. Bollack.
102. E. W. Hughes.
182. J. Higgin.
810. T. White.
911. J. H. Johnson.
1308. J. Tyler.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1417. T. F. Henley.
1435. E. J. Maumené and V. Rogelet.
1449. C. Wilkinson.
1456. T. Cattel.
1493. A. Parkes.
1500. G. T. Bousfield.
1507. M. A. F. Mennons.
1512. G. C. Grimes.
1517. J. Mills.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1353. J. Betteley.
1355. G. A. Biddell.
1369. H. Mathis.
1425. R. Keevil.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending June 11, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2717	0 3	2731	0 3	2745	1 7	2759	0 5	2773	1 3	2787	0 6
2718	0 3	2732	1 1	2746	0 3	2760	0 6	2774	0 10	2788	2 2
2719	0 5	2733	0 9	2747	0 8	2761	0 8	2775	0 7	2789	0 9
2720	1 4	2734	0 3	2748	0 5	2762	1 3	2776	0 9	2790	0 3
2721	0 3	2735	0 6	2749	0 10	2763	1 6	2777	0 10	2791	0 3
2722	0 3	2736	0 9	2750	0 3	2764	0 3	2778	0 10	2792	0 10
2723	0 3	2737	0 3	2751	0 2	2765	0 6	2779	0 3	2793	0 3
2724	0 6	2738	0 7	2752	0 6	2766	0 10	2780	0 6	2794	0 10
2725	0 3	2739	0 5	2753	0 10	2767	0 3	2781	0 3	2795	0 10
2726	0 4	2740	0 3	2754	1 5	2768	0 6	2782	0 3	2796	0 3
2727	2 7	2741	0 3	2755	0 2	2769	0 9	2783	0 3	2797	1 3
2728	1 9	2742	0 7	2756	0 11	2770	0 6	2784	0 6	2798	0 7
2729	0 5	2743	0 10	2757	0 5	2771	0 9	2785	0 3	2799	1 4
2730	0 3	2744	0 6	2758	1 10	2772	1 4	2786	1 9	2800	1 4

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, June 19, 1862.

		£ s. d.		£ s. d.	
IRON:					
Rails in Wales and North of England	pr. ton	5 0 0	to	5 5 0	nett
Welsh Bars, in Wales	,,	5 5 0	,,	5 7 6	,,
Staf. Bars, at the Works	,,	7 0 0	,,	7 5 0	,,
,, Hoops	,,	7 10 0	,,	8 0 0	,,
,, Sheets, Singles	,,	9 0 0	,,	10 0 0	,,
,, Nail Rods	,,	5 15 0	,,	6 10 0	,,
,, Boiler Plates	,,	8 0 0	,,	8 10 0	,,
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2 10 6	,,	2 11 0	nett
Do. No. 1, Good Brands	,,	2 11 6	,,	2 15 0	,,
Scotch Bars	,,	7 5 0	,,	7 15 0	,,
Swedish Bars, in London	,,	10 10 0	,,	11 0 0	,,
COPPER:					
Sheet and Sheathing	per lb.	0 0 11	,,	0 0 0	3
Tough Cake and Tile	pr. ton	93 0 0	,,	0 0 0	,,
Best Selected	,,	101 0 0	,,	0 0 0	,,
Australian	,,	99 0 0	,,	0 0 0	,,
South American	,,	0 0 0	,,	0 0 0	,,
Yellow Metal Sheathing	per lb.	0 0 9	,,	0 0 0	2½
STEEL:					
Swedish Keg	pr. ton	15 0 0	,,	0 0 0	2½
,, Faggot	,,	16 0 0	,,	0 0 0	,,
TIN:					
English, Block	p. cwt.	6 0 0	,,	0 0 0	2½
,, Bar	,,	6 1 0	,,	0 0 0	,,
Foreign, Banca	,,	6 5 0	,,	0 0 0	nett
,, Straits	,,	5 17 0	,,	0 0 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 7 0	,,	1 9 0	3
Coke, I.C.	,,	1 1 6	,,	1 4 0	,,
LEAD:					
Pig, English	pr. ton	20 0 0	,,	21 0 0	2½
,, Spanish	,,	19 10 0	,,	19 15 0	,,
Common Sheet	,,	21 0 0		0 0 0	,,
Tea ,, (Wimshurst's Patent) A special disct.	,,	33 0 0	,,	0 0 0	,,
SPELTER:					
On the spot	,,	17 10 0	,,	18 0 0	net
For arrival	,,	17 10 0	,,	17 15 0	,,
ZINC:					
English Sheet	,,	23 0 0	,,	0 0 0	1
QUICKSILVER	pr. btl.	7 0 0	,,	0 0 0	3

JAMES LAURIE, Metal Broker.
30 King William Street, E.C.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 27, 1862.

OUR DOCKYARDS AND ARSENALS.

The Spithead Forts are abandoned. The consideration of their construction is postponed; but that is the ministerial form of total abandonment. We rejoice at this decision, which we predicted long ago, and Government found inevitable. It is a sad blow for the contractors and their patrons; but it is also a lesson and a step in the right direction towards retrenchment. We are glad to have contributed some aid to the attainment of this great success, which, practically, is equivalent to two or three millions saved to the nation. Consistently, week after week, we opposed the ministerial design, and exposed the fallacies of the Commissioners' report and of a leading journal. The opposition to the Government measure was skilfully organised, and so powerful that the ministers quailed before the threatened attack, and prudently beat a retreat. Never was there a clearer case of parliamentary discomfiture. The Premier, in spite of his vapouring, has been obliged to submit to the interference of the Commons in executive measures. This is a wholesome constitutional lesson; it shows how beneficially the House can interpose its authority to put a stop to profligate expenditure, and make conditions with Government for the prudent and proper exercise of its duties.

In the debate, Mr. Bernal Osborne took the lead in his able and dashing style, which he never has surpassed. He was supported by Sir Frederic Smith with tact and judgment. These gentlemen and every other member who spoke to the purpose took the same view as that published in the MECHANICS' MAGAZINE.

But the Spithead Forts is only one phase of the national defence question; there is another, superior to it in importance, which requires to be watched with unceasing vigilance. Having aided in gaining one victory, we have acquired some title to confidence; and encouraged by the numerous testimonials of approval which have been addressed to us, we will open out the next phase of the controversy. We venture to exhort the members who have made so good a fight, and who have conquered, not to falter in their duty. A resolution is now before the House for a vote of £1,200,000, "for the de- "fence of the Royal Dockyards and Arsenals." These are the precise words, and the pith and marrow of the motion which has to be carried or negatived. We entreat the House not to yield the vantage ground they hold, but to keep ministers on their good behaviour. The bill, consisting of twenty-two clauses, has to be examined in detail by the Committee, whose duty it will be to scrutinize the purposes to which the money has to be applied, and vote on every item. As in reference to detached forts, we demonstrated their utter inutility, and traced the course to ensure their abandonment, so will we endeavour to advise the mode of proceeding, in order to secure the right appropriation of the money, if it should be voted. The crying sin of the House of Commons is that it votes away the people's money on the faith of fair promises from the officials who have to spend it, and take no guarantees for its honest and judicious appropriation. Promises are glibly given to obtain the grant; but they are quickly forfeited or forgotten when the decisive vote has passed.

The guardians of the public purse have very positively settled in what way the money shall *not be applied.* Now, let them show their good sense by prescribing in what way and to what useful purposes it *shall be applied.* £100,000 a month is a nice round sum for strengthening the defences of the Royal Dockyards and Arsenals.

The discussions which we have done our best to provoke and keep alive since the opening of Parliament, and which have been echoed to such excellent effect by independent M.P.'s who can speak out, point to the end we now aim at. The new science of iron armour for ships and batteries must be thoroughly investigated, and practically applied in its entirety. There must be no hesitation or doubt in its development. "Iron walls" must be the ramparts of England. They are the guardians of her life and independence. There must be no more trifling, no half measures, no yearnings after "wooden walls," which are condemned and obsolete. In the whole of the long and interesting debate of Monday, which marks an epoch of transition in the naval history of the country, nothing was said more to the purpose than Sir M. Peto's bitter condemnation of the *hybrid* scheme for building ships with wooden bottoms and iron top-sides, concluding with the sharp rebuke that "he should be delighted to "vote a handsome retiring pension to every "person in the Admiralty not required for the "*fleet of the future.*"

In this sentence the whole duty of Parliament on this momentous occasion is pointed out.

We must have an *iron navy*—iron built and iron clad. This is a great truth, with which every member who wishes well to his country must be impressed. There must be no temporising. Wood, as a material in the construction of ships, must be entirely and for ever cast aside. In spite of Mr. Reed's taunt, the "men of iron at any price" must and will carry the day.

Let members now be watchful in following the progress of Sir Cornwal Lewis's resolution through the House. Let them bear in mind that the true sense of "the defence of the national "dockyards," is to provide floating armour-plated iron batteries, and to adopt the most perfect mechanical combinations of iron which can be discovered for the construction of invulnerable naval armour. All the science, intelligence, manufacturing skill, and energy of the country, should be devoted to that object, and every reasonable encouragement should be given to its attainment.

We have again and again pointed out that the only way to obtain a guarantee from Government for the right application of the money voted for iron defences, is to appoint an independent committee for investigating and experimenting upon plans of armour-plating, and improving the construction of iron war ships. Until such a committee is formed, no real progress will be made in our national defences; and if its formation be not insisted upon before passing the vote of £1,200,000, the House of Commons will not do their duty to the country.

THE INTERNATIONAL EXHIBITION. —THE WESTERN AND EASTERN ANNEXES.

STEAM TRACTION AND PORTABLE ENGINES.

As among the mechanical contrivances to be found in both annexes there are some which bear a close relationship to each other, we do not scruple to unite the two departments *pro tem*, and for the purpose of facilitating description. In fact, so far as the convenience of those whose duty it is to inspect and report upon the machinery generally of the International Exhibition is concerned, it had been well if the annexes had been physically annexed to each other, instead of stretching, as they do, along either side of the Horticultural Gardens. For example, it is our present purpose to deal with a class of machines which are coming more and more into daily use, and of which excellent specimens are to be found in both annexes—we mean traction and portable engines. The first of these which arrests our notice is one exhibited by Bray's Traction Engine Company. This, considering its great capabilities, is a remarkably compact and simple looking piece of locomotive machinery. It was built at the factory of the company, by order of the Government, and when it has played out its quiet part at the great show, is intended for active service in Woolwich Dockyard. It combines many improvements upon the earlier contrivances for the purpose of transporting heavy weights by steam power; but the feathering principle of the wheels, as originally introduced by Mr. Bray, is retained. This principle consists in the circumference of the wheel having a number of small apertures through it. These apertures are the media which allow of the protrusion and withdrawal, by means of an eccentric, of a series of blades, or teeth. The teeth may be adjusted to the nature of the soil, or paving, over which the engine has for the time to travel; that is, they may be lengthened or shortened, so to speak, at the will of the attendant. In many cases the teeth are not required to be protruded at all, the friction of the periphery of the wheel being sufficient for the purposes of traction. In such case the blades may be thrown out at the top, or on that part of the wheel not coming in contact with the road. On the contrary, in the event of the ground being soft or slippery, or of the engine having to ascend a steep incline, the powerful auxiliary aid of the teeth can be brought into action, and the requisite amount of biting ensured.

It has been objected that the teeth may damage the roads over which the engine travels, but as the wheels take a broad bearing thereon, it is difficult to see the force of the objection. Power is transmitted by means of pinions hung on the crank shaft, and which work into rack wheels attached to the arms of each driving wheel near its outer circumference. Arrangements exist for altering the speed and the power, so as to suit the circumstances of the occasion upon which it is used. The engine exhibited is not intended solely for traction purposes, however, for it is fitted with a drum, which renders it available for driving any kind of fixed or portable machinery. It may thus be made available for an infinite variety of duties, in addition to its primary and nominal ones. It is, in fact, an engine of all work, and, in this capacity, is destined, we imagine, to be particularly serviceable at Woolwich Dockyard. Some other special features about this valuable steam appliance deserve notice, and they are, the introduction of an improved mode of steering, and of outside bearings for the driving wheels, which also are mounted on springs on both inner and outer framings. It may be stated, moreover, that one of the powerful engines of this company was employed in the conveyance of ordinary locomotive engines, heavy castings, and machinery of various kinds from the docks, railway stations, and manufactories, to their destinations at South Kensington. It was thus a potent contributor to the magnificent display of machinery in the Western Annex. The load conveyed, at one time, by this engine, occasionally amounted to 45 tons.

Messrs. Chaplin and Alexander, of Glasgow, also exhibit a traction engine, of a lighter character than that just referred to, but well adapted, nevertheless, for many purposes. In addition to this, the same firm supply the contractor's locomotive, which is intended to work on rails or tramways, of a gauge from two feet upwards. This is simple in construction, and the working parts are easily accessible for repair. Portable cranes, hoisting engines, and light portable engines for agricultural and other purposes, go to make up the display of Messrs. Chaplin and Co.

Taplin and Co., of the Traction Engine Works, Lincoln, are exhibitors of a traction engine of a different form to those of other competitors in the same path. This has a singularly light appearance; but it has double cylinders, is of 16-horse power, and has many advantages peculiar to itself. One of these last consists of an apparatus for regulating the height of water when going up or down hill. The mode of steering is simple and effective, and arrangements are made for carrying a sufficient supply of fuel and water for a journey of twelve miles. Fifty tons is the weight it is computed to draw. It is, therefore, well suited to the uses of contractors and others engaged in the erection of buildings, bridges, or other works of magnitude. Messrs. Taplin and Co. also show a 12-H.P. engine on the same principle, and intended for steam ploughing, thrashing, and other operations of the farmer. An 8-H.P. portable steam engine, manufactured by Messrs. Brown, Williams, and Charles M. May, of North Wilts Foundry, Devizes, is a very excellent specimen of this kind of machine. From the fact that the cylinder is enclosed when the engine is working in a jacket or belt of steam, the maximum advantage from employing steam expansively is gained. The lower part of the cylinder casting forms a steam chamber, from which the steam is taken off directly into the valve case without exposure to the effects of cold air. This is an important arrangement, because condensation and priming are thereby guarded against to a very considerable extent, if not entirely obviated. The cylinder, and, indeed, all the working parts, are attached to the top of the boiler, and thus, besides being readily accessible for repairs, are constantly under the eye of the driver.

The engine is furnished with an inside crank, which works between the bearings, so that the fly-wheel can be put on either side of the boiler, and a pulley of smaller size may be hung opposite to it if required. One end of the shaft is also prolonged, so that a coupling may be attached for effecting communication with any machinery at a distance, and employed for steam cultivation or other purposes. A steam pressure gauge, on a patented principle, is connected with the boiler, as well as a glass water gauge, and gauge cocks. The bearings are all of gun metal, and the working pins, nuts, and screws, are all case hardened. The boiler is well adapted for the rapid generation of steam, the heating surface being equal to 20 square feet for each horse power. The barrel of the boiler, which is made of Low Moor iron, and in some cases of steel, is clothed with a casing of hair felt and wood, for the prevention of evaporation, and over all is a protecting covering of sheet iron. The ash pan is fixed close round the fire box, and fitted with a door, which may be used as a damper. The greatest care appears to have been taken to prevent live coals or cinders from falling to the ground, so that the chances of accident from that cause are materially lessened. On the whole, there is no doubt that, for compactness of form, and probable economy of working, the engine of Messrs. Brown, Williams, and May will bear comparison with any contrivances used in this country for similar objects. Mr. Holman, of Cannon-street, City, is, we believe, the agent in town for this firm.

In the branch of agricultural engineering, which is becoming every day of more and more importance, and which is attracting more and more the attention of the general engineers and machinists of the kingdom—in this branch Mr. Burrell, of St. Nicholas Works, Thetford, Norfolk, shines conspicuously at the International Exhibition. Perhaps the combined portable engine and windlass is the most noteworthy of the specimens of agricultural machinery from the Thetford Works, and of this and its mode of action, therefore, we may give a brief description. The cylinder and gearing are placed on the top of the boiler, as it were, but yet independent of it. Any portion of the working parts may thus be removed for repair even while the steam is up. Beyond this there is nothing extraordinary in the construction of the motive portion of the engine, but the mode of communicating motion to the windlass and the windlass itself are worthy of remark. The windlass consists of a single sheave five feet in diameter, and around which the rope is made to take half a turn. The groove into which the rope passes is formed of a series of small leaves, which, on the application of the least pressure, clasp and hold the rope until it takes the straight line on the other side, when the clips open and release it. By this simple and self-acting arrangement, all short bends which are found to be so detrimental to wire ropes are avoided. The small "leaves" referred to are made of chilled cast-iron, which, of course, is not liable to wear rapidly, and they may readily be removed and replaced when desirable. An upright shaft, driven by a bevil pinion on the crank-shaft, puts the windlass in motion.

The plan of working is thus described by the maker of the implement:—"On the headland "is placed the engine and windlass, and "directly opposite to them the anchor, which "is set moving. Between these the plough—"if a plough be in use—is pulled backwards "and forwards, one end of the plough being "alternately in the air, and the other in its "work, thus avoiding the necessity of turning "on the headlands.

"The plough being constructed with patent "slack gear, the rope is lengthened or shortened "as the irregularity of the field may require, "and at the same time both ropes are kept "sufficiently tight to prevent their trailing upon "the ground. By these means a great saving "of draught is effected, and the wear and tear "of the rope by friction is obviated." Any other implement than the plough may, of course, be worked in the same manner.

The anchor used with the combined engine and windlass, is a patented contrivance, and is so made that its resistance to side strain is due to disc wheels, which cut their way for some distance into the ground. The frame is entirely composed of wrought iron, and a box at the back is intended as a counterpoise to prevent the apparatus being pulled over when engaged on very heavy work. This machine is managed by a boy, who also attends to the shifting of the rope porters. Patent balance ploughs, and cultivating machines, flour mills, and thrashing machines, are exhibited in the Eastern Annex, by Mr. Burrell, together with many other appliances of minor importance.

The well-known firm of Clayton and Shuttleworth, in addition to their various contrivances for facilitating the operations of agriculturists and others, exhibit two specimens of portable engines. These consist of the "improved "outside cylinder engine," and the "portable "steam engine;" they are both creditable productions, and may be made applicable to numerous purposes, besides those of agriculture.

Messrs. E. R. and F. Turner, of Ipswich, who have been exceedingly successful at the various shows of the Royal Agricultural Societies of this and other countries, exhibit amongst a great number of steam and hand implements for the carrying on of agricultural operations. Amongst these is a small portable steam engine, which has some excellent points about it. The cylinder is 6¼ inches in diameter, and the length of stroke 10¼ inches. The fly-wheel, which also serves as a driving pulley, is 4 feet 4 inches in diameter, and it is intended to make 140 revolutions per minute. The crank-shaft is of wrought-iron, and admits of the fly-wheel being hung at either end, as may be found most convenient, and of the attachment of an additional pulley when necessary. The strength, simplicity, and cheapness of this appliance, constitute its strongest recommendations, and it is not improbable, we think, that at the present show of the Royal Agricultural Society of England, at Battersea Park, the Messrs. Turner may add another laurel to their chaplets—or at least another medal to the number already won by them.

In the way of traction engines, the Messrs. Robey and Co., of Lincoln, to whom reference was made in a former notice in respect to other contrivances, give us a very good example of their capabilities in this particular department; and Messrs. Richard Hornsby and Sons, of the Spittlegate Iron Works, Grantham, are not behind their neighbours in their display of portable steam engines and agricultural implements generally. The double-cylinder engine of this firm is, indeed, a well contrived and determined looking machine. In awarding the first prize, on a recent occasion, to Messrs. Hornsby, for an engine of this description, the judges appointed by the Royal Agricultural Society stated that "the engine worked up to "its full power, at a less pressure of steam "than the others exhibited, and is better fitted "for the variable service required from it on "the farms, by reason of its possessing fuller "command over its work. We believe that "the advantage possessed by the other engines "in respect to their own consumption of fuel "would be found to disappear in actual service, "when the appliances for reducing the area of "their fire-grates were removed. The fire-"grate of Messrs. Hornsby and Sons' engine "was in its ordinary state at the time of the "trial."

With this testimony, no doubt the firm last named were well satisfied, and with it must close our remarks this week on steam appliances for tractional, agricultural, and other purposes.

INDIA-RUBBER MANUFACTURES IN THE INTERNATIONAL EXHIBITION.

The great advance which has been made in manufactures generally during the last ten years, is in no instance, perhaps, more apparent than in the one above named. In the Exhibition of 1851 there were only some three or four representatives of what was then a secret trade, or one which, at any rate, was trammelled by patent rights, which prevented its extension. Since that time great strides have been made, and the exhibitors of india-rubber manufactures in 1862 number no less than thirty-four, of whom twenty-three are English, the rest coming from Germany, France, and Prussia, and one from St. Petersburg. There are also several exhibitors of articles made in gutta-percha, and one of a proposed substitute for india-rubber.

In reviewing what has been done, and pointing out what our readers will find in the building, we purpose taking each section separately, for their convenience in reference, as well as our own in writing. To commence with our own country, and the Eastern Annex, to which india-rubber manufactures—like many others, equally worthy of better positions in the main building—have been condemned, we find upwards of twenty exhibitors of various manufactures in this material, to say nothing at present of gutta-percha, and other analogous substances.

Prominent amongst these stand the original patentees in England, C. Macintosh and Company, of Manchester, who have three cases here, containing specimens as applied to various purposes. The manufactures of this firm are too generally known to need much comment; but we may particularize, as worthy of notice, the beautiful specimens of raw material in their large case, showing the process of manufacture, from the masticated lump to the finished sheet. They also exhibit suction hose, buffers and springs, driving bands, tubing of all colours, and a peculiar make of hose, consisting of leather and india-rubber combined, which, we should think, for some purposes, an improvement on the ordinary kind. They have, also, an application of tubing for the illumination of railway carriages by gas, which, we understand, has been tested on the Lancashire and Yorkshire Railway, and found practicable. This being the case, we sincerely hope that its adoption will be universal in *every class* of railway carriage, as well as on all lines. In educational appliances, an inflated globe for the use of schools merits attention, as a very simple and cheap substitute, and decided improvement on "*the use of the globes.*" The one exhibited is about three yards in circumference, the price being only £3 10s.

Next in importance are Messrs. Silver and Company, and Messrs. Warne and Company, who stand forward pre-eminently as enterprising producers of the newest improvements in the manufacture and application of the material. Silver and Co., with their ebonite, which is similar in appearance to the old vulcanite of 1851, stand by themselves; no one having hitherto been able to produce the material satisfactorily in this country. They exhibit, as practical applications, tubes or pipes of large dimensions, which are not affected by acids, for the use of vinegar and dye works; bottles and funnels, photographic baths and dishes, (in place of gutta-percha,) coated harness irons, bracelets and chains, for ornamental use in place of jet, as well as numerous other things. In soft vulcanized india-rubber, great credit is due for a very ingenious mat for doors or halls. This is produced by making incisions with a sharp knife at regular intervals and spaces in a sheet of the unvulcanized material, so that when stretched out small diamond squares are formed, and being kept open by mechanical means during vulcanization, a mat is produced, firm to the foot, and excellently adapted for the purposes required. They also exhibit washers, valves, steam packing, hose, &c., all of which show a great advance in finish and quality. We have recently noticed the india-rubber insulated wire of this firm, as well as their ebonite pole-insulators, which will be found, with other telegraph appliances, in Class 13.

Messrs. Warne and Co. exhibit several very novel and useful appliances of the material. Their "junction rubber" for piston rings, pump buckets, &c., made of soft and hard rubber combined, is a very ingenious and valuable application, as also their "patent screw shaft "water-stop" for ocean steamers, which prevents the necessity of stoppage for repacking when at sea. This is effected by the inflation of two rings so arranged as to answer the end required, whilst the stuffing-box is being repacked. They also show an elastic bath towel, having a rubber warp alternate with cotton; "red mineralised rubber;" "ferruginous "cement packing;" a very ingenious flesh brush, and their "aromatic bands," which are all worthy of notice as improved appliances of the material, as also an "Archimedean screw rifle cleaner." Messrs. Warne and Co. were the first to introduce the use of india-rubber for door-mats, samples of which they exhibit. These are formed of sections of tubes cemented together. They are well adapted to the purpose, and are extensively used. The whole contents of this case, which is situated by the wall on the left-hand side of the Annexe, are well worth the attention of our readers and the commercial public.

On the opposite side, in the centre passage, will be noticed a very handsome case devoted to the exhibition of overshoes, hose, belting, &c., manufactured by the North British Rubber Company of Edinburgh. This firm, which, we believe, consists chiefly of Americans, possess the advantage of the superior knowledge attained in that country, where the india-rubber trade has been so much more extensively developed than in England, and, consequently, their goods at once strike the eye as superior to what we have seen elsewhere. This is shown particularly in their overshoes, which, indeed, is a branch of the trade that has hitherto only been carried on in France and America. The shoes exhibited here, however, very far exceed in beauty of make and finish those of either of the other makers. This is not only apparent in shoes, but in the other three articles to which their manufacture is confined—valves, hose, and belting. In front of their case, let into the floor, is the largest valve which has ever been made, being 6 feet 4 inches in diameter, and 1¼ inches thick, made of pure rubber, in the manufacture of which no solvent has been used. In their hose there is a clearness of finish which must place it in favourable contrast with other makers.

India-rubber hose must eventually supersede leather, as being more durable and cleanly, and for fire-engines certainly possesses advantages from its smoothness of bore, and consequent non-resistance to the passage of the water. The same advantages are possessed by india-rubber belting for machinery, which is daily superseding the use of other kinds.

The belting shown by the North British Company is of remarkable strength, and yet possesses a requisite amount of elasticity. Numbers of the machines in the Western Annexe are driven by these bands, as well as the pumps of the large French fountains in the Horticultural Gardens. In the same case are shown combs manufactured by another branch of the firm—the Scottish Vulcanite Company—which are very good specimens of the variety of patterns and shapes which may be produced in the material.

Coming down the Annex we find a cluster of smaller cases, each containing specimens of india-rubber manufactures. Chief amongst these we remark that of Messrs. P. B. Cow and Co., of Cheapside, which contains a most elegant collection and arrangement of useful appliances. Their waterproofed cloths, of every shade of colour and substance, are superior articles. Great care is evidently given to this branch of their trade, and their specimens deserve attention. Amongst other things they show a knapsack and haversack combined, which from its lightness, compactness, and general finish, would be invaluable to the tourist; also a ladies' yachting jacket, of fine but strong material, which must become an essential in the outfit, not only of yachting ladies, but all those who take long voyages. The floor of this case is covered with an inlaid pavement of hard rubber in various colours, which we should like to see tried practically in some position where its merits or defects could be ascertained. The effect is pleasing, and we should think, if not too expensive, the application is a good one.

Mr. J. L. Hancock exhibits an ingenious "portable air-bed chair," for invalids, which can be packed in a very small compass for travelling; Messrs. Tuck, their elastic steam packing; Mr. Wansbrough, his patent flocked cloth; Mr. Foster, of Streatham, various articles made from waste vulcanized rubber; Mr. Hodges, his excellent accumulators or springs; and Mr. Horsey, of Lambeth, a variety of small but useful articles for personal use.

Mr. Hooper, of Pall Mall, and Messrs. Hall and Wells, exhibit specimens of their manufactures; the first in vulcanized sheet rubber, &c., and the latter in elastic braids and fabrics. Both these firms also exhibit, in Class 13, the application of india-rubber to the coating of telegraph wires for submarine and aerial purposes, as named in our recent article on telegraph apparatus. The india-rubber covered wires of Messrs. Hall and Wells exhibit excellent material and superior workmanship.

Messrs. Spill and Co. have a large assortment of waterproof goods, as well as specimens of their vegetable leather made up in various forms. There are also several exhibitors of kamptulicon floor cloth, which is a compound of india-rubber and cork.

Before leaving the Eastern Annex there is one case to which we would draw the attention of those interested in the subject, and that is the one containing samples of "campticon, or india-rubber substitute," exhibited by Messrs. F. Walton and Co., of Chiswick. The high price which india-rubber has reached, and the greatly increased consumption, render the question of an economical substitute a great desideratum. The paper which was recently read before the Society of Arts by Mr. F. Walton, and which was published in the journal of that Society, very clearly describes the nature of the new material. It is made from oxidised oil, so treated as to remove all unctuous matter, and is formed into a semi-elastic resin, which for many purposes, such as steam packing, driving bands, and hose, is said to answer equally as well as india-rubber, at a considerable less cost. It can be supplied in either dough or solution, and as a hard compound vulcanizes as readily as india-rubber, without the use of sulphur. We shall hope to hear more of this invention, as we believe it will prove an important addition to the known elastic and waterproofing gums.

The Gutta-Percha Company have a very good display of their general manufactures in this annexe, their insulated wires being with the other telegraphic apparatus within a short distance of their case. Mr. C. Hancock exhibits a large and extremely elegant sideboard, enriched with very beautiful mouldings in gutta-percha, which well deserves the attention of every visitor, showing, as it does, the adaptability of the material to such purposes. On the top is a well-executed model of a dog reclining on a roughly-shaped block of gutta-percha, the effect of which is extremely good. Passing into the main building, we find in the French Court several exhibitors of tubing and vulcanised rubber goods generally, and from Hanover three or four, two of which deserve more extended notice. These will be found in the south-western transept.

Messrs. Cohen and Co., of Harburg, make the most extensive display of any one in the building, consisting of india-rubber goods generally—overshoes, clothing, tubing, toys, and a very elegant and useful mat or carpet for doors, stairs, railway carriages, &c. These mats are quite a novelty, and attract the attention of all who pass that way. Unlike any we have described, they resemble more than anything a grey carpet with a raised pattern, the honeycomb designs standing up from the back of the mat quarter to half an inch. Their general appearance is extremely good, and Messrs. Cohen deserve the greatest credit for their introduction. By the side of this case are shown specimens of india-rubber combs in great variety, made by the Gummi-Kamm Company, of Harburg. Close by these, in the centre of the transept, are three exhibitors from Prussia—Messrs. Blanke, of Magdeburg; Bolle and Co., Berlin; and Faurobert and Reimann, also of Berlin; they do not, however, show anything specially worthy of notice, the general appearance of their goods having nothing to attract the eye, and being badly displayed, prevents the possibility of judging as to their quality.

In this transept, near the steps leading to the western dome, is placed a statue in hard rubber, but if it is exhibited with any idea of the introduction of the material for artistic purposes, this monstrosity of ugliness will certainly defeat the end in view. In colour it is a snuffy brown, and reminds one of the mottled figures shown in cheap confectionary stores, which make you feel uncomfortable when looking at them. We should advise its removal altogether, or the application of a coat of whitewash to drape its ugliness.

There is but one other stand to which we would draw attention, and that is the exhibition of the Russian India-Rubber Company, of St. Petersburg, which is placed in the north-west gallery, and we mention this only to draw attention to the fact we have before named, of the superiority of the manufacture when directed by American skill, the manager of this company being a gentleman who has had long experience in that country. They display overshoes, hose, and belting of very superior quality. Many of the boots are specially adapted to Russian wants, and we should think they must be thoroughly appreciated in their severe winters.

The india-rubber trade is yet in its infancy; and the advances that have been made during the past ten years will, we feel assured, be far exceeded in the decennial period before our next international display. Ingenious and enterprising manufacturers will spring up, who will improve and invent, adding to the many valuable appliances of the material which are daily made. We should not go so far as the late enterprising Charles Goodyear, who proposed to erect a house of hard india-rubber, but we see many things to which it may be applied with success, creating new and profitable industries for our teeming population to replace those which in the course of time either die out or change their localities. And it is to these periodical exhibitions that we must look for the advance of thought and interchange of idea, and which will tend eventually to bind all nations together in a firmer bond of brotherhood.

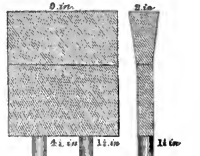
THE IRON WALLS OF OLD ENGLAND.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

LETTER XVI.

In commencing my communications, I said their main object was to provoke discussion on the national question of "iron walls." That object has been attained beyond expectation. Every week so many plans are addressed to me, I confess my inability to do them justice, and some correspondents may think themselves slighted. But I cannot encroach upon your space to notice plans devoid of novelty. I have made your readers familiar with several classes of armour-plate fastenings, of which the "frame fastening" is the most prolific in protean forms; but all these involve the same defect in principle—want of adhesive power—from which it seems impossible to exempt the class.

I have now before me three varieties. Mr. Mulley, of Plymouth, whose letter appeared in your columns, so frankly and kindly invites my opinion on his plan, I cannot do otherwise than respond in the same spirit. His neatly-made iron model, which is now in the hands of Mr. J. Watts, the Chief Constructor at the Admiralty, shows the system very clearly. I am afraid words will not make the following description so accurate as I could wish. Taking armour-plates of any given dimensions, say 6 feet by 3 feet, and 4½ inches thick, the two edges longitudinally are slightly bevelled to the extent of about half an inch each from the outside inwards. A frame fastening, two inches wide at the top, and bevelled precisely to the same extent as the plates, but in the contrary direction, is placed between the edges of the latter, and, consequently, forms a dovetail head, fitting precisely to those edges longitudinally. But this frame fastening is not all in one piece as in the Scott Russell, Plum, Lancaster, and other inventions for holding plates by their edges, with a dovetailed rib. Mr. Mulley divides his rib into segments, of which here are diagrams; in this respect he has introduced a novelty.



Each of these segments is 9 inches wide, 1¼ inches thick, increasing to 2 inches at the head to form the dovetail, and terminates in two 1¼-inch bolts, forged with and forming part of the segment. These segments placed side by side form the dovetailed rib which holds the plates. The points of the bolts are passed through holes drilled in the skin of the ship, and are secured inside with rivets or screws and nuts. "The under edges of the lowest strake "of plates are laid on a recess, and show a "projection of 13½ inches—that is, 4½ inches "plate, and 9 inches wood backing. The segments would then be placed side by side; the "points of the bolts being against the skin "plating, the holes for them would be markep "and drilled. When the points were put "through, the dovetail heads would be fitted "close down upon the upper edges of the "same strake of armour-plates; and their upper "sides being made fair, would receive the lower "edges of the second strake of plates, and so "on in succession." The result, when the work is completed, is to hold the plates longitudinally (the butts may be likewise so held) in the same way as by Mr. Scott Russell's flush dovetail headed ribs. The latter is continuous and all in one, and the former is also continuous as regards the holding surface, but in segments, which has this advantage, that one segment might be fractured without damage to its neighbours, as they are separate pieces. "A broken segment or damaged plate could "be easily and promptly replaced without the "disturbance of others." These are decided advantages; and when the simplicity and inexpensive nature of the mode of fixing the armour to the side of a ship are considered, the superiority of the plan over Mr. Scott Russell's difficult and expensive method of continuous rivetting after the plates are fixed, is incontrovertible. So far I go with the inventor, but I have no faith in his keys introduced at the top and bottom of some of the segments, and let into the plates for longitudinal strength, because incisions of any kind into the outer surface of plates are sure to be found out by the projectiles and become the origin of cracks. Nor can I admit that "the whole would form a compact "mass *grasped tightly* and securely to the "ship's side." It appears to me that longitudinally only one edge (the upper one) will be "grasped" at all. The lower edge will rest upon the top side of the row of segments, and when the bolts of the top row come to be rivetted, as they draw the upper edge of the plate inwards the lower edge will be slightly thrown off.* The entire back surface of the plate will not bear on the backing, and the plates will be liable to be cracked and the bolts to be torn away by vibration. Mr. Mulley has carefully considered the subject, and knows what he is about; I am sorry I cannot give an unqualified approval of his plan.

The plan of Mr. Geo. B. Cooper, of Drury-lane, is a system of irregular surfaces, of a somewhat complex nature. The idea of mitigating the effect of projectiles by deflection from convexities, has been tried in various ways and proved to be a mistake. Mr. Westwood, the iron shipbuilder, and a Mr. Roberts, had targets made on that principle. When struck by projectiles the protruding surfaces were broken off. In the recent trial of Mr. Scott Russell's target, to which there were two kinds of fastenings holding the edges of the armour plates, one convex similar to Mr. Cooper's design, and the other flush, the latter stood much better than the former, which peeled off in strips. The teaching of experiments tends to prove that a perfectly level surface to the outside of the armour plates, and a fastening not exposed to impact, are two main conditions of success. Mr. Cooper seems to have been at great pains in contriving various combinations to attain strength of resistance. As he is a practical engineer who knows how to conquer mechanical difficulties, his notions are worth attending to, and I advise him to submit his plan to the Iron Plate Committee, who will examine it carefully, and report upon it conscientiously. "Amateur, Perth," has conceived a species of backing of so remarkable a nature that I cannot venture to offer an opinion on it. As he is very desirous of giving publicity to his idea that it may be made known and discussed by men of science, I will introduce it in his own words. "Seeing in the "Mechanics' Magazine the number of plans "of armour plates experimented upon, and the "result of each trial, I am persuaded that "solidity of backing is required to make an "invulnerable vessel.

"It appears wood, as a backing, is of no use; "I, therefore, suggest a plan, which, if it is not "itself adopted, will perhaps advance that most "desired system of armour-plating.

"It is well known that water is very slightly "elastic. I, therefore, propose to back the "armour-plates with water pressed to a fit "pressure."

The "Amateur" thinks there will be no practical difficulty in confining the "water "backing" in skins, compressing it to any required degree, or in fixing it at the back of the armour plates. I have done my duty in making his plan known, I must leave your readers to form their own conclusions.

"J. N." has a plan, which he properly terms "hanging on" the armour on the sides of the ship, which misleads so many inventors, which is the notorious defect of the Warrior system, and which, nevertheless, is persisted in by the Admiralty in the construction of other ships. To enable iron plates to develope their resisting force, they must be *grasped securely* and drawn tightly to a rigid backing. This can never be effected with through bolts, unless they be so large and so numerous as to materially weaken the plate by the number of perforations. "J. N." also trusts partially to dovetail fastenings at the back of the plates into the wood backing, but wood affords not the slightest hold for iron against the crushing effect of projectiles.

F. Spiller conceives the idea of placing the armour-plates *inside* the ship with the ordinary skin plates outside, and a thick backing, or rather "fronting" to the armour between it and the skin. Thus the structure of the ship, which the armour should protect, would receive the full damage of the unresisted force of projectiles. This inventor must reconsider his plan, and shew a mode of construction which shall convert the armour-plates into an inner frame of the ship, and render repairs possible, neither of which conditions exists in his plan as at present arranged, but I will not say they are impracticable.

In advancing facts I rely on my own observations, or what I believe to be good authority. If I am mistaken, I am ready to acknowledge my error. These remarks refer to the letters of some of your correspondents which I am about to notice. "C. F. T. Y." contradicts my statement that a steel punch will not penetrate a plate thicker than the diameter of the punch. *To the letter* he may be right, for he states what is no doubt true, that he succeeded in punching a 1¼-inch hole in a ¾-inch plate. But this must have strained the machine, and was a "*tour de force*," for which "C. F. T. Y." has a taste, for he admits he broke a machine in trying to force a 1¼-inch punch through a 1⅜-inch plate. I am obliged to him for corroborating a fact which has an important bearing on the penetrability of iron plates. Ane minent engineer, whose punching, sheering, and rivetting machines stand A1 at the Exhibition, told me that a punch of equal diameter to the thickness of a plate could be forced through the plate by widely coning the die, but as a rule the diameter of the punch should be 1-8th more than the thickness of the plate, and if that rule be disregarded either the machine or the punch gives way, but the plate is not penetrated. In this "punching" discussion we are talking of *steel* punches, not cast iron shot. If steel will break rather than be forced through a given thickness of wrought iron, cast iron will not do half the work.

Dr. Ashby, of Enfield, suggests that a mass of woven wire would oppose a more efficient resistance to projectiles than iron plates. I will not discuss his theory, but answer it with a fact. Your report of target trials of the *11th April last*, gives an account of a series of experiments on targets constructed in the manner Dr. Ashby recommends. Woven iron wire and iron plate formed the structure of these targets in different proportions. On trial, the strength of these targets was in a direct ratio to the predominance of plate, and in an inverse ratio to that of wire.

A letter, signed "A Mechanic," takes up the defence of Mr. Scott Russell's target. He doubts my penetration, but I have enough to pierce through the disguise the writer assumes. The hand is the hand of "A Mechanic," but the voice is the voice of "Scott Russell." No doubt he is quite as anxious to justify his *bias*, as I am to prove that my prediction was fulfilled. We all like to show we are right, but with your correspondent I wish to establish the truth. In reply to "A Mechanic," I need hardly add a word to the observations on this target in my last letter. We do not differ so widely as he supposes. I might admit his facts (he does not deny mine), and still my conclusions would be the same. The difference between his view and mine is, that he looks only at the *apparent* effects on the face of the armour plates, and I look to the *real* effects behind the target, on the backing and the ship's structure. Of what avail is a continuous frame holding the outer edges of a plate, if the rivets which hold the frame and form the real fastening are torn away? Suppose an iron bar, fixed as a barrier across a gate; if the staples which hold the bar are drawn, of what use is the bar? The weakness of Mr. Scott Russell's system at the back is the cause of the plates not curling at the ends. This effect would have occurred if the back support had not given way. As to continuous *rivetting*, that is not the *principle* of this plan. The principle is *holding* with a continuous dovetail head, which Mr. Russell produces by hammering down the protruding ends of angle bars between the plates *after these are fixed*; but this is an awkward, expensive, and imperfect method. Plates can be held more firmly and securely at their edges by fixing dovetailed frame bars *first*, either in long or short lengths, and fitting the plates to them *afterwards*. Half a dozen methods of effecting that object in a far more simple, workmanlike, and efficient way, have been brought under my notice, and some of them are known to the Iron Plate Committee. Mr. Mulley's plan, which is one of them, is in the hands of the Admiralty, and will, I hope, receive the attention it deserves. Mr. Austin's letters will be noticed next week.

A Civilian.

THE ANNUAL MEETING OF THE ROYAL AGRICULTURAL SOCIETY.

The annual meeting of the Royal Agricultural Society, at Battersea, is a complete success. There are two miles of shedding devoted to the various animals domesticated by man for his own use. The list of the agricultural implements not in motion fill upwards of 440 octavo pages of the guide book, and consist of machines for making bricks and tiles, cheese-making apparatus, draining tools, fire-engines, harrows, irrigators, mowing and reaping machines, chopping machines, lifting jacks, and sewing machines, which are useful in making sacks, &c.

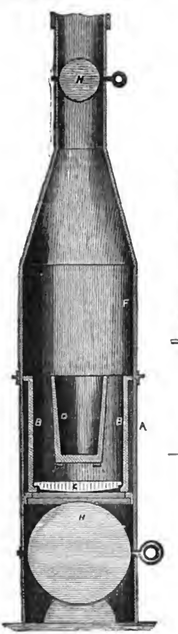
Messrs. Hornsly and Sons show three engines and two threshing machines, the latter with considerable improvement; and Mr. Underhill exhibits a new grain elevator, which most of the manufacturers of the combined machines have introduced in aid of the finishing process. Messrs. Ransome and Sims' six steam-engines, ranging from 5 to 14-horse power, form quite a feature of the yard; and a constant crowd is attracted at the spot where the eight different food-preparing machines are exhibited. These machines are also driven by one engine. It will be remembered that at the society's meeting, at Chester, four years since, Messrs. Tuxford and Sons obtained the first prize for steam-engines. Since then there have been no prizes awarded, and it may be considered that, in the opinion of the society, they still maintain a decided superiority in this department. With one hundred weight of coal their engine works up to 8-horse power during three hours and forty-seven minutes. Garrat and Sons have four engines and combined threshing machines at work, all of which are of the best workmanship. Messrs. Clayton and Shuttleworth amuse the public by sending up the straw as it falls from the shaker in bundles to be dropped loose upon a stack at some distance. Messrs. Richardson and Darley exhibit superior traction-engines; and the engines of Messrs. Ruston and Proctor are fitted with Giffard's patent injector, which is quite a hydrostatic puzzle. The water by means of it is supplied to the boiler without the expenditure of power, without wear and tear, and at a temperature of about 170 degrees Fahr. A very ingenious contrivance is exhibited by a Mr. Smith, for directing a blast of hot air to lift the corn as it descends from the first riddle, to be finished above, tending to dry damp samples.

Mr. Collinson Hall exhibits two patent sectional drums and steel rope for steam cultivation, to be used with locomotive engines of from 10 to 30 horse power. The object of the invention is to supersede the costly wire rope and round drums, with a simple, cheap, and durable substitute. The rope is formed of round steel rods, half an inch of diameter, and 18 inches long, and by means in 4-inch plates rivetted one on each side at the end of the rods, a rope is obtained of any required length. In fact, the rope consists of a mere multiple of rods and plates, which are then passed round a drum having a number of flat sides to correspond with them. Ruston & Proctor, Holmes and Son, and Sparkes, exhibit various contrivances for sawing by steam; and Messrs. Warren, Fowler, and Norton, numerous pumps and bone mills.

A very useful kind of wrought iron gate, the invention of Mr. Webb, of Smallwood Manor, Utoxeter, is shown by Mr. Bewley, who is its manufacturer. It consists of the orthodox number of bars, which are united to three uprights by means of rivets on which they turn. A balance projects from the top bar, which being pressed by the hand the gate rises with the greatest ease. It fastens of itself on falling into its place, and it is obvious that it cannot be opened by horses or cattle.

The Economical Microscope.—Mr. Pillischer, the well-known maker of microscopes, has recently invented a new moveable stage, remarkable for its great simplicity and complete efficiency. The motor apparatus consists of two flat metal bands, having a moveable joint; the shorter of these bands is attached to the left-hand corner of the stage, and to the longer a small handle is fixed. By means of this extremely simple contrivance an object standing in the field of vision can be moved in any direction with the greatest facility and nicety. Mr. Pillischer has adapted this apparatus to a microscope which he sells for £5. This instrument is furnished with an English quarter-inch object glass, which by division makes also half and one inch glasses. These object-glasses possess good defining and penetrating properties. We have carefully examined the microscope in question, and find it to be an excellent instrument, fit for almost any description of scientific investigation; indeed it is a marvel of cheapness, the stage movement and the object glass being worth, without the stand, the whole of the money.—*Lancet.*

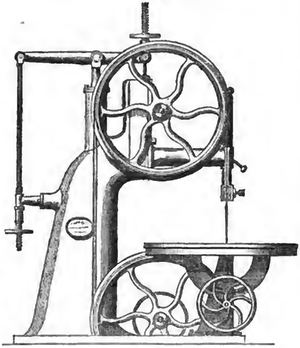
CHESTERMAN'S FURNACE FOR HEATING AND HARDENING SMALL STEEL ARTICLES.



This invention, by Mr. J. Chesterman, of Sheffield, consists in the using a stove, as shown above. *A* is the outer case of the stove or furnace; *B* is a metal or clay lining to the same; *C* is the grate or fire-bars; *D* is the pan or vessel, made of any suitable fire resisting material, for containing the flux (made from minerals) in which the articles to be heated and hardened are placed; *E* is the fire-place; *F* is the conical cover which can be made to rise or fall, and *G* is a door to the cover; *H H* are dampers for regulating and increasing the draught of the furnace.

A great advantage resulting from the employment of a flux composed of chloride of sodium, soda ash, sal-enixum, chloride of zinc, or other mineral which will become liquid under heat, is, that the articles cannot be overheated. For example: if a razor blade be made red-hot, and be left, say, an hour in the flux, even the thin part of the blade will not be in the least injured; moreover, the uniform heat which the steel receives prevents its cracking, or becoming what is termed "water-cracked;" and, lastly, in consequence of the steel being protected from the action of the atmosphere, the finest mark on it. remains unimpaired. The steel articles come from the oil or water clean and bright, which is of great importance, particularly in hardening files, dies for buttons, coining, and for other purposes. This stove is well adapted to warm a room or shop, and is good for melting gold, or silver, and other metals. Broken gas-coke is the best and cheapest fuel for this stove.

IMPROVED ENDLESS BAND SAW MACHINE.



Messrs. Powis, James, & Co., the patentees of this machine, say:—"Our patent gives the above machine an important advantage over all others yet brought out, on account of the arrangement made to prevent the saw from breaking. The saw wheels ride upon compound adjusting springs, by which means the saw will yield freely to any sudden strain to which it may be sub[illegible] sawing sharp curves the saws are liable [illegible] and in this case the springs act mechani[illegible] take up the slack without having to scr[illegible]p a second time, which is not the case with the old inventions. In all other machines, it frequently happens that the workman neglects to ease the saw to prevent its being crumpled, the result is, the instant the machine starts again, the saw breaks, more especially when the saw has been set up a second time to take up the slack caused by expansion. This is, in consequence of the bearing being a fixture in the older inventions, and therefore unable to comply with the requirements of the saw, but which our patent entirely provides for."

Messrs. Siemens, Halske & Co. in a communication say:—"In the article which appeared in your last number but one, on the 'Electric Telegraph and Electrical Apparatus' at the International Exhibition, we observed an erroneous statement regarding the manufacture of our cables, the external coating of which is *said* 'to consist of tape saturated in shell lac and pitch; this mixture is in turn finally covered by a band of brass sheathing, wound on while the cement is still soft, the completed cable being afterwards drawn through a hot die.' The insulated conductor or conductors in our cables are first covered with two or more coatings of hemp strings, saturated in Stockholm tar, laid on under a given strain spirally round the core, and the sheathing consists of metal strips (copper, brass, &c.), applied by a revolving die with great pressure, but *we particularly avoid the application of heat* in every part of the manufacture of our submarine wires."

CAPT. FISHBOURNE'S LECTURE AND THE SUBSEQUENT DISCUSSION AT THE UNITED SERVICE INSTITUTION.

Capt. Fishbourne so ably refuted the arguments of Sir W. Armstrong and Col. Lefroy, that we cannot do better than refer our readers to the Journal of the United Service Institution, which has just been published. We are certainly surprised at Sir W. Armstrong's admission that the smooth-bore is the most suitable for a naval broadside gun, and that he is now engaged in manufacturing smooth-bores—and we are equally surprised at his partner, Mr. Rendels stating that the 9lb. shell fired out of the 12lb. gun was not "reduced at all," for we find that Col. Lefroy admits that it was reduced to 8lbs., by which means, as is evident, a velocity not attainable by the service projectiles was got and published in the *Army and Navy Gazette* to deceive the public! It is to be regretted that the competitive trial conducted by the select committee did not take place with wrought-iron guns, for it was not the strength of cast-iron which should have been tried, but which of the systems of rifling was the best adapted for using high charges and attaining the necessary high velocities.

We observe that two gentlemen did not compete, not wishing to enter the lists with guns which, it seems, the Select Committee do not consider fit for any sort of rifling; these were Mr. Whitworth and Mr. Lynall Thomas, the former firing an iron shot, and the latter a lead-coated projectile. Both are having very large wrought-iron guns made at the Government expense. Of what use, then, is the competitive trial? Did it take place to amuse the public? And why were not Mr. Whitworth and Mr. Thomas included, and a trial conducted upon equal terms in every respect? This would have enabled a fair comparison to be made on the relative efficiency and cost to the country of each system. But as the trial has been conducted, the money spent and the time and expense to the competitors have been less than wasted. This experiment, which can lead to nothing, has extended over more than twelve months, and all this time the multigroove has been applied to the wrought-iron guns made, though evidently unsuited to high velocities, and considered by the inventor (Sir W. Armstrong) to be inferior to the shunt.

The construction of the coil guns, which appears to have cost one year before any tolerably heavy gun was produced, was entirely conducted at the public expense, and it is, therefore, much to be re-[illegible]etted that such vast sums and great efforts were expended upon only one experiment, which has not yet resulted in producing powerful and durable naval guns. In truth, the whole of the multigroove rifled artillery is of too small calibre for actual warfare, and hence a new class of smooth-bores, of larger diameter and greater power, are to be constructed—an alteration which was foreseen by naval gunnery officers.

In a lecture given at the United Service Institution, in April, 1861, and which especially called attention to the subject, it was stated that new naval guns should be of eight or ten inches or more diameter; and it was given as a reason by the naval author that "without great size, the round ball would have little smashing power; nor could a high velocity be obtained from the elongated shot, unless they offered a large area, *in proportion to length*, for the powder to act upon in propelling them."

This Sir William Armstrong has just admitted, and shown by a diagram the inferiority of small bores, and experiments are now in progress at Shoeburyness by Mr. Whitworth, to obtain a short shot, and consequent high velocity; in fact, the value of uniting the high velocities of shot, or round shot, with the capability of using elongated shell of large powder capacity, seems to be not generally admitted.

The present cast-iron guns are on all sides admitted to be too weak. They won't stand sufficiently high charges for firing round shot, with the high velocities necessary to operate successfully against plated ships, much less bear the reduction of windage, which is so advisable, but which will be of little avail, unless the guns were aimed with accuracy. If, therefore, they cannot be strengthened by a strong and cheap covering, such as that proposed by Captain Blakely, and apparently successful with the Parrott gun in America, and likewise successful at Shoeburyness in 1856, it is evident that the result to be expected from Mr. Lancaster's plan of encasing their breech beyond the trunnions would not be worth the expense, unless, indeed, cast-iron can be shown to be the strongest, instead of, as it is, the most brittle metal for the interior of guns. Experiments should, therefore, be made to fully test the strengthening by means of a long and thick wrought-iron coil over the seat of the shot, and all further supply of new cast-iron ordnance should be at once stopped.

With respect to the Armstrong 110-pounders, one of them should be re-bored and rifled in three grooves, and the effect of firing simple iron projectiles should be tried, and, if successful, as it would probably be found, the lead coating should be given up, by which a vast saving would be accomplished.

The lessening of the inertia and strain, by using a lighter projectile, and the lessening of the detention of the shot, would enable a high charge to be used, and great velocity to be obtained. This alteration would only involve the small expense of a change of grooving, for it is believed that the breech-loading would then answer, and a good gun of only 80 cwt., firing a round ball of about 50 lbs., and iron elongated projectiles, from 50 to 70, would be obtained for our lighter frigates; the smaller Armstrongs might answer for shore purposes, coast defence, and volunteer use, &c.

One of the ablest of our artillery officers lately stated, that it is clear that so far as "work done" on impact is concerned, any increase in weight above the sphere must be positively disadvantageous within certain limits of range." And again, "that to engage a properly constructed iron-clad battery with any reasonable chance of success, the attack must be made at very close quarters; in fact, at a range where, practically, little or no advantage would be gained by the use of rifled ordnance in respect to accuracy of fire, and retardation by the resistance of the atmosphere." Again, "that the results obtained in the Shoeburyness trials—although they cannot be taken to measure the relative values of the systems—practically demonstrated the great advantage, in respect to penetration at moderate ranges, of the light shot and heavy charge over the heavy shot and light charge; for, notwithstanding the comparatively small momentum of the 68-pounder shot, namely 106 000, it had nearly, if not quite as much effect on the target as the 140 lb. shot, with a momentum of 170·000."

The arguments against breech-loaders of large size are so conclusive that no more should be made unless some better plan than the present can be discovered; the great expense of lead-coated shot is likewise a very strong reason for their discontinuance.

We have now arrived at a certain amount of perfection in the construction of coil guns, and it would be as unwise to at once give it up, as in the case of the sudden abandonment of casting, which was lastly discontinued at the period when the first difficulties had been successfully overcome, and guns of greater strength than any since the Carron castings were beginning to be made—a fact disclosed by subsequent proof. A very hard compound of copper, of great strength, not unlike that used by the ancients for casting tools, had also been discovered by the talented head of the Chemical Department, Mr. Abel, but these improvements were swept away by the change, and further experiments discontinued.

Doubtless the superintendent of the Royal gun factories, whose bullet-making machine alone is sufficient to show him to be one of the ablest mechanics of the age, is able to give us good muzzle-loading guns of the pattern of the 8-ton gun, which he has just completed for Mr. Whitworth, and if good steel can be produced for the interior, it would leave little to be desired except as to withstanding hostile shot and lengthened ordnance; and, therefore, experiments should be carried on to obtain a metal that withstands knocks, and is less liable to deterioration.

As respects the best gun, we must not, while aiming at the highest efficiency, omit the idea of expense; and in this view, the rifling of Mr. Whitworth is more than three times as costly as any of the plans of "grooving;" and as short or light shot, with a high velocity, will be in most respects advantageous, it is necessary for them to have bearings sufficiently firm to resist high charges without yielding, and this seems to me only capable of being effected by an iron bearing on the shot, and a shoulder in the gun.

Lastly, as regards the obtaining greatest efficiency from each gun, Sir William allows the advantage of combining the round ball with the elongated rifle projectile, but doubts its being done. Most of the other inventors who have favoured us with their views, say that it is attained by their plans, and Capt. Fishbourne shows the importance of uniting them for naval guns.

Granting that this is the case, and it has been virtually admitted by Sir William, the result of our expenditure is that we have no guns now fit for the broadsides of our iron-clad ships, and it is, therefore, evidently not desirable to waste the country's resources upon the further manufacture of inferior multigrooves, but at once to fully and fairly test other plans of rifling, while proceeding with the manufacture of larger smooth-bores, which may be afterwards rifled when the best mode is fully established.

ARTILLERIST.

SAFE WORKING PRESSURE OF BOILERS, AND HOOPING OF FLUES.

Mr. L. E. **Fletcher**, the engineer of the Manchester Association for the prevention of steam boiler explosions, in his last monthly report says:—

For some time since I have been desirous of touching upon the point of Safe Working Pressures for boilers, since it not unfrequently happens that it is necessary to warn our members on account of excess.

The scale adopted by the Association as a general standard is as follows:—For shells of boilers 7 feet in diameter, made of $\frac{3}{8}$th plate, the safe working pressure is 50lb.; if of $\frac{7}{16}$th plate, 60lb.; and other dimensions in proportion. This allowance corresponds with the general practice of the manufacturing engineers of the district, is quite as high as the standard in other parts of the country, and considerably in excess of that permitted either in France, Holland, or Belgium, by their respective governments. It must, however, be distinctly understood that this standard should not be applied arbitrarily in every case, without any allowance being made for the attendant circumstances. It is only applicable in cases where the boiler is well made, both as regards materials and workmanship, and where the condition of the plates is good. It would be highly dangerous to apply it to boilers weakened by the wear and tear of years; while, on the other hand, a new and thoroughly well made boiler might for a time be allowed to work at a pressure slightly in excess of that given. But this could only be safe where everything is in first-rate condition.

It is a very common idea that the bursting pressure of a boiler is six times as high as that given above as its safe working pressure. This, however, I am persuaded is a great mistake, and leads in many cases to undue confidence. I am confirmed in this conclusion by the constant examination of the rent plates in boilers that have exploded, where I find that, even where explosion results from thinning of the plates, rupture ensues long before they are reduced to one-sixth of their original thickness, and in one case I knew a well made and nearly new boiler, in first-rate condition, to explode, on account of only a comparatively slight increase of pressure, which had accidentally been allowed through an error in the steam gauge. In this case, that at which the boiler actually burst did not exceed its ordinary working pressure by more than 50 per cent., the one being about 90lb., the other about 60lb. I believe that an application of anything like six times the pressure given in the scale above would burst most of the boilers in Lancashire, and where it has been actually attempted by hydraulic pressure, the steam domes have been found to tear off long before the strain referred to has been attained. I cannot, therefore, think that shells of cylindrical boilers can be worked without risk at a higher pressure than that given in the preceding scale, unless under very exceptional circumstances.

With regard to the furnace tubes which are exposed to external pressure, I am glad to find that the practice is becoming increasingly general of strengthening them either with flanged seams or hoops, the hoops being made either of angle iron, T iron, or other approved form; and since it too frequently happens that flues are not made in the first instance truly cylindrical, on which their strength so much depends, and that other sources of weakness creep into the manufacture unawares, it is extremely desirable that no new boiler should be constructed with flues unstrengthened in the way just described, however slight the working pressure may be.

These hoops are frequently added to boilers after their first construction, and since some of our members have suffered inconvenience from the imperfect manner in which they have been fixed, I may state the method found by experience to be the best, which is as follows:—The hoops, if made in two halves, may be passed in through the manhole, and can then be secured to the furnace tubes when in position. They should not, however, be brought in direct contact with the plates of the tube, but should have ferrules of about an inch thick placed between the two, so as to leave a clear space all round through which the water can circulate. Where this space has been omitted, the plates have been found in some places to crack at the rivet holes, and in others to blister and buckle, in consequence of which many plates have had to be cut out and the hoops removed, from which the system of hooping has been in some cases unfairly condemned. Where, however, the ferrules have been introduced and the water space allowed, no injury has been found to arise to the plates even over the hottest part of the fire. The rivets uniting the hoops to the furnace tube should pass through these ferrules, and be spaced about six inches apart, while the two halves of the hoops should be connected together by butt strips rivetted to their ends at the back. When hoops are applied as an after-clap in this way, angle iron is preferable to T iron, as the flange, being narrower, is less liable to cause overheating of the plate. It may be necessary to vary the size of the angle iron in some cases, but, generally speaking, one three inches in the flange and half an inch in thickness will be found to answer every purpose. It is sometimes the practice to put two angle irons back to back. This is quite unnecessary, and a single one is all that is required. A drawing, to show the arrangement recommended, has been made for the assistance of the members, and can be seen on application at the offices of the Association.

Since writing the above, I have met with some additional cases, where considerable expense has been incurred by having to remove angle iron hoops from furnace tubes, in consequence of the injudicious mode in which they have been fixed, and would therefore impress upon our members the importance of attention to the above, if they wish to prevent the recurrence of disappointment in their own case.

THE INTERNATIONAL EXHIBITION.

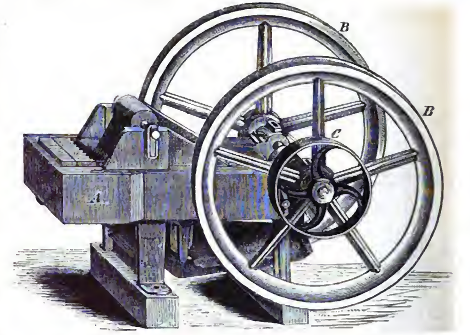
THE AMERICAN COURT.

No. 3

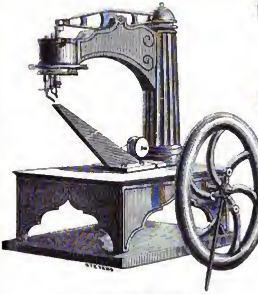
AMONG the many useful inventions from the United States, perhaps the most remarkable is the power loom for weaving tufted fabrics, to be seen in operation in the Western Annex. This loom is the invention of Mr. Smith, West Farms, New York, and is intended for weaving the Axminster carpets, or any other tufted or pile fabric which requires cutting, and is produced to a pattern. Unlike either the Jacquard or the old draw loom, the pattern designed is formed by the arrangement of the spools or bobbins, which are suspended over the machine to the number of 270. These produce a pattern the whole width of the material and 1½ yards long; and at every throw of the shuttle a piece of mechanism rises up like so many fingers, catches hold of the worsted threads, and weaves them in, across the whole width of the fabric. A knife or shears then passes swiftly over it and cuts off the tufts to any length required. By this means any design can be woven in parts, which, when united, will have the appearance of having been woven in one piece, and the loom will produce twenty-five yards per day. As the mechanism for forming and cutting the tufts is readily adjusted to any desired depth of pile, the loom is equally adapted for the manufacture of rugs and mats, and at a cost much less than such fabrics can be produced by any other method. The Americans are very confident of this loom; it has received great attention from scientific men, and Earl Granville has publicly stated that it is destined to achieve greater results than perhaps any other machine in the building.

A curiosity has made its appearance in the American Court within the last week, in the shape of a machine for milking cows. The idea is not a new one, as we have read of machines for the purpose twenty years ago, but the machine appears to be simple and ingenious in its construction, and requires no adjusting in changing from one cow to another. The teats, either two or four at once, are inserted in as many india-rubber tubes; a vacuum is created by working two small levers, and the milk is drawn at the rate of one gallon per minute, in a way more agreeable to the animal than by milking with hand, and the milking process is more cleanly.

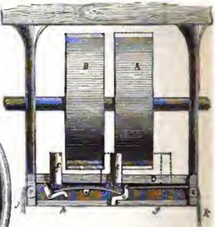
Mr. L. A. Bigelow, Boston, Massachusetts, exhibits several machines connected with boot-making, which receive, as they deserve, much attention. First of all there is a machine for splitting the leather, or rather, as we would describe it, for paring the leather intended for soles to a uniform or required thickness. This is effected by passing the leather between two rollers, one grooved, and the other smooth, behind which is a knife which may be adjusted in relation to the frame according to the thickness of the leather required. The cutting is accomplished rapidly, and with more precision than can be done by the hand and knife. Then we have a machine for cutting up the leather into soles, which it does at the rate of twenty pair a minute, all fitted exactly to the last, without the use of a hand-knife, and the edges sufficiently smooth to finish. Further, there is a "heel trimmer," that is, a machine which, carrying the boot or shoe on a pivot, subjects it under a circular motion to the action of a cutter, which in a minute pares the rough edges to the form of heel, whatever the thickness may be. And lastly comes the sole sewing machine, illustrated by the above engraving, which is much on the same principle as the sewing machines for lighter material, with which the public are now familiar. Of course it is more ponderous and powerful, having a force sufficient to penetrate the thickest leather, or even a board half an inch thick. It uses a heavy waxed thread, drawing the thread more tightly than can be done by hand, and making the work both strong and solid. This machine will sew on the soles of one hundred and fifty pairs of boots or shoes per day, of whatever thickness, and the labour of managing it is a pleasant pastime.



BLAKE'S STONE BREAKER.



SOLE SEWING MACHINE.



GOAR'S BELT SHIFTER.

Mr. Bigelow also exhibits Blake's stone breaker, an extremely simple and useful machine for superseding or economising human labour. It is intended for breaking stones for concrete, railway ballast, or metal for roads, and it easily crushes flints, granite, greenstone, and the most obdurate trap boulders to any dimensions required. We should like to see such a machine in use in this country. We have seen on the roadsides, especially in the north, men, and even women, exposed to the heat of the sun, toiling hour after hour in breaking stones for the highways, an occupation requiring no skill, and remunerated at the rate of eighteen pence a-day. In this case the stone breaker would be a happy innovation. The working of the machine may easily be described with the aid of the adjoining cut. *A* contains two jaws, one, next the end of the machine, fixed, the other moveable, working upon a pinion at the raised part of the machine just before the fly-wheels *B B*. Both jaws are armed with teeth, in the form of vertical grooves. The moveable jaw inclines at an angle more or less acute, according to the dimensions it is required the stones should be crushed or broken. This angle is regulated by a simple contrivance behind the moveable jaw, which is put in motion by the action of the fly-wheel working on a crank. The stones to be broken are put into the fore-part, as into a hopper; the moveable jaw advances and recedes from the fixed jaws; the stones descend and are masticated, or "chawed up," and issue from the lower part of the machine in fragments of the size required. The great simplicity and power of the stone-crusher is exemplified in a small working model, where flints, about the size of a pigeon's egg, are crushed into atoms in less than a minute, by a few turns of a crank with one hand. The machine is worked by hand-power or steam-power according to its dimensions. As to capacity, a three-horse machine will crush a stone 10 inches by 5 at the rate of four cubic yards per hour.

Goar's belt shifter is a very happy contrivance for shifting and securing machinery belts. Its utility will at once be admitted by those who understand how frequent has been the occurrence of accidents by the common method of shifting belts. The engraving represents a vertical section of the apparatus, with two pulleys *A* and *B* upon the same shaft, the pulley *A* turning loosely, and *B* being keyed firmly to the shaft, so as to carry the shaft with it in its rotations. The shifter is

FIG. 1.

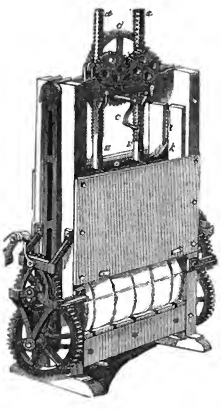
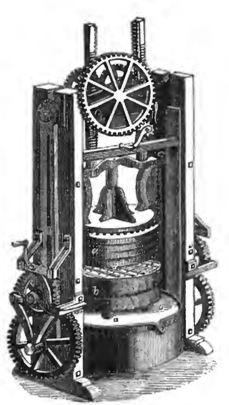


FIG. 2.



ECKEL'S PRESSES.

represented in the cut in position to hold the belt upon the tight pulley *B*. The slide *C* with its two jaws, *e* and *f*, embracing the belt, is fitted to slip backward and forward on the bar *D*, carrying the belt along in its movement, and thus shifting it from one pulley to the other. When in the position shown in the cut, the end of the beam *g* enters the notch in the bar *D*, and thus holds the slide *C* securely in its place. Now, if it is desired to stop the machine by lifting the belt to the loose pulley *A*, the operator draws the cord *j*, which first lifts the end of the lever *g* out of the notch, where it is firmly held by the spring *i*. By drawing the cord *k*, the belt is shifted back upon the tight pulley *B*. Behind the levers *g m* and *h* pins are placed to stop the levers from being drawn too far over. The cords *j* and *k* may be led in any direction, or they may be both attached to a lever, so as to be operated either backward or forward.

Another very simple contrivance of great use is a machine for addressing newspapers, exhibited by Mr. Sweet, of New York. A wooden disc, from the edge of which projects all the letters of the alphabet, is made to revolve by a treddle; a small wooden block is pressed against the letter required, till the address is cut out on the face of the block. It is then placed along with hundreds of others similarly cut upon an endless band, and having been inked, the band carries them round, and as one by one they descend on a small table, the newspaper, or whatever is to be addressed, is pressed against them by a pressure of the foot, and a thousand addresses are copied in a few minutes. This apparatus is in use in most of the newspaper offices in New York, and must greatly facilitate the despatch of journals which are supplied directly from the office and not through the intervention of newsvenders. Of course such a machine would be very useful to English newsvendors.

We have illustrated two presses, exhibited by Eckel, of New York, which are remarkable for power, and of very beautiful construction. Fig. 1 is a cotton or baling press, which will put 600 lbs. of cotton into 18 cubic feet, or 500 lbs. of hay in a common sized bale of 5 feet long, 2 feet wide, and 32 inches high. The gearing attached to the crosshead at the top of the press is first employed to run down the plunger through the principal part of its descent. The material to be pressed is placed in the box, the door being removed for this purpose, as shown in the cut. The plunger *D* is forced down by turning the crank *C*, and thus turning the gear wheels which mesh into the racks upon the stems *E E* of the plunger. The stems are prevented from rising by pawls *J J*, which catch into the ratchet *A A*, secured to the sides of the stems. When the plunger has been forced as far down as can be done by the power applied through the medium of the gearing at the top of the press, the gearing at the bottom is brought into play to complete the compression of the bale. This operates through an eccentric to draw down the crosshead farther with great force. The strong metallic straps *G G*, at the sides of the frame, are rigidly secured at the top to the crosshead, which has a sliding motion up and down through a short distance in the upper part of the frame. The shaft *H*, with the eccentrics *M M* upon it, passes through the straps *G G* at the bottom; the plunger being held down by the pawls *J J*, the crosshead is drawn down by turning the eccentrics *M M* through the medium of the strong gearing at the bottom of the press. When the plunger is carried as low as desired, it is held in place by pawls *K K* catching into the pawls *L L* while the bale is being roped and its covering sewed.

Fig. 2 is a prospective view of the oil or tallow press; the curb *A* is of peculiar construction, being an iron cylinder, cast solid, 38 inches in diameter, heavily banded with tire iron on the outside, and the inside is ribbed every inch. There is an iron lining rivetted to the ribs, perforated with upwards of 11,000 holes, which forms avenues or escapes for the oil on the sides of the curb. This curb is placed on a wrought-iron disc or saucer C, 4 feet 6 inches in diameter. There are three or more plates for dividing the material, and a centre tube as follows:—The bottom plate is ribbed, and perforated between each rib, to afford great freedom for the oil to escape from the bottom. It has a seat for the *centre tube*, which takes the oil from the centre of the cheese *B*. The centre tube *D* is a stout iron cylinder, perforated with holes from top to bottom, and passing through the centre of the central and top plates, and thus the oil escapes from all parts almost instantly. It will be observed that this press is very simple, having no blocks or screws or levers about it; all that is required being to put in the plates and turn the cranks which run down the plunger.

There are many other articles in the American Court well worthy of description. We have selected those chiefly which are remarkable for mechanical contrivance or invention, or from their novelty were worthy of a passing record. The sewing machines will be noticed in a future paper. As we stated at the outset, the United States have, under a distressing peculiarity, done wondrously well; and ere another decade shall have come round, they may be able to show to a greater extent, if not to greater advantage, as regards invention and utility.

Proceedings of Societies.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, May 16.—Sir Henry Holland, Bart., M. D., D.C.L., F.R.S., Vice-President, in the Chair.

JOHN SCOTT RUSSELL, Esq., F.R.S., "ON THE IRON WALLS OF OLD ENGLAND."

IT was not the first time the speaker had been allowed the honour of expounding such truths as had been the object of his special study, but he had never treated on one of so great national importance. He was somewhat rash, perhaps, in accepting from the managers the title of this address,—rash because the subject was *then* in a state of transition. It was even worse now, for it had come to what geologists had called a "slip;" he might almost say he found himself at "fault." What he had to say *now* was as different as possible from what he should have said when he made the promise. Six or eight months ago he should have met here a formidable phalanx of adversaries—amongst them nearly all the naval officers —arrayed against him as the advocate of iron ships of war, and he should have had to argue every point as he proceeded. But unfortunately *now* we were all on one side; the pugilistic encounter which might *then* have entertained his audience could not come off. Twelve months ago he had written a pamphlet showing that the end of wooden men-of-war was at hand, and that it was a sin and a shame to send our sailors to sea in them; but the authorities of that day brought their *guns* to bear upon him and completely demolished him. Since then, however, he had got up again; and his heterodoxy had become orthodoxy, and he thought there would be no opponent of "iron walls" for the future. About the beginning of the year we were on the eve of war with a people who, whatever their faults, never hesitated to adopt for war the fittest weapons,—who, long before rifles were introduced into our army, were celebrated for their use of them and for their manufacture,—to whom we are indebted for the revolvers we found so useful in India, and which, whether they invented them or not, they brought to perfection. That people excelled also in ships; for while the English people, priding themselves on the beautiful "wave lines" on which their fast steamers were built, were slow to perceive the advantage of the same lines for their sailing ships; the Americans adopted them for their sailing vessels and came over and beat our fleetest yachts in our own waters. It was the Americans, too, who first built ships of large size, and carried off our best freights in their large wave-line clippers. When going to war with such a powerful nation it became necessary to take stock of our fighting material. The Government did take stock of your fleet; and the extent of your navy, fit for a naval battle, at the beginning of the present year—as announced in a powerful leader in the *Times*—was *one ship* of the line. At the present moment we have *two* ships of the line fit for service, the Warrior and the Black Prince, and no more. This serious point is no longer a matter o speculation. It is now universally accepted as a fac —and accepted by us on a very small naval engagement in American waters, the contest of the Merrimac and Monitor,—that an iron vessel of war is better than a wooden one; while the battle of the Merrimac with the Congress and Cumberland has settled the point of dispute eight or nine months ago, *viz.*, that a wooden vessel could not sustain the attack of a ship of war in iron armour. Sir John Hay, the chairman of the naval commission, is quoted in an excellent article in the *Quarterly Review*, as using this expression,—"The man who goes into action in a wooden vessel is a fool, and the man who sends him there is a villain."

Let us now enquire how this revolution has come about. How is it that our brave sailors ought no longer to face our enemies from behind our wooden walls? The revolution has been chiefly brought about by the introduction in artillery of *horizontal shell-firing*. A certain General Paixhans, a Frenchman, contributed more than any one else to this result. He made cannon of eight or ten inches bore, by which explosive shells—which previously had been fired up in the air and had come down again upon their object—could then be fired straight at the mark, especially at a wooden ship, which was as good a target as an enemy could possibly desire. This horizontal firing was for a long while a favourite idea with artillerists; but they had very little opportunity of trying it in practical war. Sir Howard Douglas, speaking of its effects, says, "A shell exploding between decks acts in every direction; under the deck it would blow up all above it; on deck it would make a prodigious breach below it, at the same time that it would act laterally." The shell which accidentally exploded on board the Medea, on the lower deck, killed the bombardier and several of the crew, knocked down all the bulkheads, and threw the whole squadron into consternation; and the like effects was to be expected from an enemy's shell lodged before its explosion had taken place. The first experiment on a large scale in actual war was at the commencement of the Russian War. The Russian fleet, sneaking about the Black Sea, put into Sinope, and in a very short space of one morning sunk and burnt the Turkish squadron. This battle was the entire effect of horizontal shell-firing. The true nature of this horizontal fire has had another illustration. You were all astonished, and wanted to know why Sir Charles Napier did not take Cronstadt, and that our other fleet did not take Sebastopol. It was well known to professional men then why we did not, and there is now no reason why the secret should be kept. Our enemies know it, so why not our friends? Our sailors were not fools enough to stand to their guns in wooden ships exposed to horizontal shell-firing. The speaker had read a letter from Lord Dundonald, one of the bravest sailors that ever trod the deck, written by him to Napier off Cronstadt, in which he expresses the greatest apprehension that Sir Charles would be goaded on to try the attack with what he called combustible ships. We tried Sebastopol—or rather we tried to "make-believe." We drew up our fleet a *great way off*, and one or two brave sailors did go in closer. But the Russian gunners were trained to horizontal shell-firing, and they soon found out it was best to be farther off. The admiral was to be considered the wisest man on board the fleet, for *he* anchored his ship the *farthest* off. Those ships that ventured in were rendered by these shells incapable of continuing the action, and it is not now considered a disgrace to those sailors to say that after three shells had exploded in one ship it was not possible to find men "fools" enough to stand to the guns. "Now, you know why we did not take Cronstadt; and why you did not know it sooner, was because the Government did not wish you should fail to believe in the wooden walls. At last, however, the Monitor and Merrimac have let out the secret, and I am here to tell you the whole truth." It need not be said that those shells at Sinope and Sebastopol were not the perfect weapons we have now—the Armstrong shells are much more precise, and will scatter greater destruction around them. How *much* more I may not tell.

Attention has, therefore, since 1854 till now, been strongly directed to inventions for protecting ships from the effects of shells—and shot also, but chiefly shells. Men will stand against shot, but not against shells; they will run the risk of being hit, but will not face the certainty of being blown up. The invention of iron armour took place fifty or sixty years ago. He was not prepared to name the first inventor; but long before we thought of using it in our navy, Mr. R. L. Stevens, a celebrated engineer, of New York, the builder of some of the fastest steam-vessels on the Hudson, was, he thought, the inventor. Certainly Mr. Stevens, between 1845 and 1850, gave him a full account of experiments made in America, partly at his own and partly at the State's expense, and found that six inches thickness of iron-plate armour was sufficient to resist every shot and shell of that day. In 1845, he (Mr. Stevens) proposed to the American Government to construct an iron-plated ship, and in 1854 the ship was begun. This ship is in progress, but not yet finished. Mr. Stevens is therefore the inventor of iron armour; but no doubt the first man who applied it practically for warfare was the Emperor of the French. In 1854 he engaged in the Russian war, and being a great artillerist, he felt deeply what his fleet could not do in the Black Sea, and we could not do in the Baltic, and so he put his wise head to work to find out what could be done. In 1854 the Emperor built some floating batteries—four or five; we simply took his design, and made five or six.

He had called the introduction of iron-armour ships, Stevens's and the Emperor's; but something he laid claim to for ourselves. Stevens used thin flat plates one over the other; but Mr. Lloyd, of the Admiralty, being consulted at that time, did express his opinion that solid 4½ inch plates would be more effectual than the six inches of thickness in a congeries of plates. Mr. Lloyd has some of the merit as well as the Emperor for the adoption of this kind of armour. The speaker exhibited a model of the first iron batteries. The form, he said, was not very handsome; in short, they were not only not good sea-boats, but in a sea good for nothing. They did, however, in smooth water, some good work; at least three of the French Emperor's did. We never got so far. They went to the Black Sea—to Kinburn; and when they came back they were covered with the marks of shot, but not one of them was seriously damaged. This proved the value of these coated vessels, and so convinced the Emperor, that he *wisely* determined the fleet of France in future should be an iron fleet. We all know with what decision, what success, what economy he has carried that idea out. "I have here," said the speaker, "the means of showing you what this armour is. Now to tell the secret of the efficacy of an armour plate. First, as a matter of fact, it *stops* the shot, as an anvil stops a hammer, and stops it outside the ship; and so, therefore, the armour acts practically as an anvil. When these plates were made they were made to resist 8-pounders, and 4½ inches thickness was ample; but now they were firing shot very much larger. When a round ball, or a round shell strikes the iron plate, the first thing done is, that it stops the *bit* of the ball that first touches the armour; next, the bits round it rush on until they, too, get stopped by the armour; and so this *little* (!) ball makes a dent for itself; the remainder of the crushed ball seems, as Mr. Faraday says, to be "squermed" out of shape. I stole the word, it is so capitally expressive. The shape is not like the original ball,—it is an entirely new form altogether. I call it "Faraday's squerm." But we have not the full weight of mettle here. We have only a part of the shot left, the remainder is dispersed in numerous fragments. This is all that remains—a beautiful, smooth, polished, cone; the rest has gone everywhere. What meanwhile has happened to the armour? The plate first gets a dent; if Sir William Armstrong hits it twice in the same place the dent gets deeper; and if he hits it again in the same hollow, as he so maliciously does, the dent parts company with the plate and starts on a voyage of exploration for itself. But if this ball (150-pounder) were used, I am sure that at the first hit it would take a piece of its own size away with it. Now, if this occurs with a solid shot, what would happen with a hollow ball made to explode, and fired at the ship? Fortunately we know what would happen. We have seen it fired, and it not only got smashed to pieces, but it *forgot to explode;* and the only excuse that can be made for this is that it had not time to do so. I do not know if you know what takes place inside of a gun: but artillerists know it takes some 4 or 5-1000ths of a second for the explosion to go from one end of the charge to the other. Explosion in a shell also takes time, and what happens with the shell striking the armour is that it gets shattered to pieces and the powder scattered about *before* it has time to explode; and this not only with four-inch iron, but with plates a great deal thinner." This power of annihilating shell is one of the advantages which iron bestows on a ship, and for which wood is powerless; and upon this very fortunate fact the new principle of naval construction is based. for whatever armour will do against shot, it will infallibly keep out the shell. What kind of armour is best against shell and what against shot is still a subject of discussion. The most important results were being worked out by the committee on iron plates as to the best adaptation of armour for the purposes we want.

To the speaker's mind, the best kind of armour and the best kind of ship was that combined in the Warrior. There was one gun-deck, in which a battery of guns of the heaviest calibre was placed and that battery was entirely covered with iron plates backed with eighteen inches of wood lying between them and the iron skin of the ship. A great effort was now being made to get rid of this wooden backing, which was liable to rot and contributed no strength to the vessel. When an effective iron backing was constructed. the last improvement would be got that was looked for in the construction of an armour-plated ship. He then explained what were the great difficulties to contend with in the construction of the new fleet. There was no difficulty in the armour; we know we can keep out the shell and the shot; for if Sir William Armstrong pushes us too hard, we know how much more iron will keep him out. What we have to do that is difficult, is to build a ship that will not merely keep out shell and resist shot, but also *possess speed with good sea-going qualities*—a monstrous difficulty. The problem was purely one of naval architecture. The difficulty arose in this way: the iron armour placed a very great weight in a very bad place; it tended to make the ship top-heavy and "crank." Now, such a vessel rolls, and a very heavy roll might roll her upside under—an event to be avoided as long as possible. The puzzle was, therefore, to make a stable ship that should stand under this great top-weight of armour, and be a good sea-going vessel. The first iron batteries were totally devoid of this quality. They were not "ship shape," but "sea chest" shape. Those we sent out to the Black Sea—and one was under a very good captain—never got there, or, if they did, they never did anything but come back again. He referred to them because they were a class of ships that were now being agitated for. The question was now being entertained, in the highest quarters, as to whether our new fleet of vessels should be fit for long voyages and able to encounter heavy seas, such as were necessary for the protection of our colonies and commerce; or whether they should be made unseaworthy slow vessels, incapable of following the enemy if he ran away, still less of catching him. They were only adapted for staying at home; and in order to hurt the enemy, the enemy must come to them to be hurt.

Mr. Scott Russell then went into the details of what he advocated as the best class of shot-proof vessel—the improved Warrior class. This class was 58 feet wide, 400 feet long, and more than 7,000 tons in size, and cost, fully armed and fitted for sea, not much short of half-a-million. The distinguishing quality of the Warrior was, that she had proved a very excellent sea-going vessel. He was happy to say that four more of this class were building, and two already built. Her armour consisted of 4½-inch iron plates, and extended over the whole length to be protected, and came down about 5 feet below water. This arrangement of armour was such, that its centre of gravity was brought to 6 feet above the water. Now, for a comfortable ship it was held, that the centre of gravity should be near the water line, and this was therefore a problem of some difficulty; but the ship had turned out, nevertheless, a faster man-of-war than any other, and also an easy, good sea-boat.

This difficulty of top-weight was got over, in Stevens's early armour vessel, by a different method from the Warrior. Giving up the problem of a sea-going ship, he took to smooth water, and built his vessel much on the mid-ship section of a London barge; the sides sloped outwards under water, and sloped inwards above water, so as to form a narrow upper deck, carrying seven guns, the angles of the sides being usually a little above water, but capable of being sunk to the level of it during action. So little, however, was she adapted for a sea-going ship, that a false side was obliged to be put up to make her at all seaworthy; and he would only ask our naval officers if such vessels were fit to protect our trade and our possessions on the wide ocean? The Stevens battery is as long as the Warrior, is to have as high a speed, and carry a central, shot-proof platform, with seven large guns mounted on turn-tables, and worked below decks by machinery. The guns were pointed downwards for loading, and were returned to their positions, and worked thus by men and machinery below the iron deck, and wholly under cover. There were points in this battery so like some recently proposed to be constructed in this country, that it was difficult to conceive that the secret had not transpired. This battery was begun in 1854 and is now about to be finished. The Stevens battery is a favourable specimen of a ship built for action in the smooth waters of America. But it is our duty to construct quite a different class of ships, and the Warrior is the type of that class. No one can help seeing the superiority, for our uses, of having such vessels only as can go anywhere and do anything, and are faster, more powerful, more enduring, and more seaworthy than any other steamships of any other navy.

The Merrimac, one of the most beautiful of the American frigates, that first set the pattern which has been followed in so many of our own noble vessels, was cut down by the Southerners, and said to have been covered with rails; but, in reality, covered with one coating of plates, six inches broad, and an inch and a half thick, laid diagonally, and a second coating two inches and a half thick, in an opposite direction, over a backing of wood. By this simple means she was converted into the formidable vessel that attacked so victoriously the Congress and Cumberland, and disabling them by the shells poured in, as much as by her power as a ram, destroyed them in a short encounter. The Monitor, improvised by Ericsson in three months, is 160 feet long, 40 wide, and 6 feet deep, and below this upper body is another, propelled by steam. She carries a revolving iron tower, of six inches thick, containing two heavy guns. Now, the upshot of the contest of these two vessels has decided two points for us. 1. That wooden men-of-war are worthless in presence of iron-coated ships; for the Merrimac sank two of them without the slightest difficulty. 2. That wooden ships, even coated with iron, are ineffective against iron ships coated with iron armour; for after a long contest, the Merrimac failed to injure the Monitor, and had to retire.

Captain Coles's shield vessel was next described. His plans were submitted to the Admiralty in 1859, long prior to the construction of Ericsson's battery. These shields and the Monitor's are much alike in principle; but Captain Coles's vessel is a far better sea-boat than the Monitor, and carries twelve guns instead of one, as in that vessel. Coles's shield has a conical roof, and carries one or two Armstrong 100-pounders fixed in slides, which are parts of the interior of the shield, that moves round on a central pivot, and the men working the guns are turned round in it entirely under cover. The construction of the shield ship designed by the Admiralty is altogether better than the Monitor's. The speaker does not wish, however, to see our war-ships replaced by vessels of this class, but by those worthy of ourselves—a fleet of Warriors.

Mr. Scott Russell hoped he had now shown how it had come to pass that we had got a useless navy of wooden ships, and only two iron ones ready for service. There were two more nearly ready, not of the Warrior class, about which the less he said the more he should praise them. The Government had, however, laid down the lines for four more enlarged Warriors, and this was an atonement for the two he would not say anything about. We must, then, look to a long time before we shall have more than two ships of the Warrior class. He considered this delay deplorable. When the Duke of Somerset was asked in the House why he had not sooner built more iron ships, he said, "The House of Commons had been in no particular hurry." And when he was asked about his tardy adoption of Captain Coles's plan, he replied, "He delayed until he had consulted the House of Commons about it." Now, the serious difficulty was this, while the French Emperor had been making rapid use of his experience of iron batteries, we had not. In 1854, his were at Kinburn and up to their work. In 1856, Captain Halsted made application to have one of our batteries made the subject of experiment, in order to see if she would resist shot and shell, with a view then to make an iron navy. The Admiralty did have the Trusty made ready, and had her out. Then they took fright, and sent her back again; and so we lost two years' start. He would now mention a fact of which there was no longer any grounds for concealment. In 1855, he submitted to the surveyor of the navy a drawing and model of the Warrior class of ships. That model was now on the table, and exhibited all the important features of construction of the Warrior class. But the Admiralty delayed the construction of the first ship of the class till 1859; and so we lost our just claim to the original design of iron ships in armour, with sea-going qualities and speed united. It was Sir John Pakington who, in 1858, first ordered an iron fleet to be commenced, on a joint design of himself, Mr. Scott Russell, and the Surveyor of the Navy. But the French Emperor had already commenced the Gloire; so that instead of being, as we might have been, three years ahead of the French Emperor, our delay had given him the lead, and deprived us of our true priority. He concluded by expressing a hope that the delays and doubts of the Admiralty might now end; that a fleet of enlarged Warriors would speedily be constructed, fit to carry English sailors on every sea where our colonies and commerce required their protection; and that no more of our time or money would be wasted in the consideration or construction of inferior classes of vessels, unfit for ocean navigation, and good only to stay at home until the enemy should choose to come and be hurt. We had now proved our Warrior class to be sound, wholesome sea-going ships, and to be unparalleled in speed. Of course, improvements would in future be made, and changes introduced. But when our constructions truly embodied the best knowledge and experience of their time, our responsibility was fulfilled; and at present we know of no match for the enlarged Warrior class of 7,000 tons, and therefore there can no longer remain any excuse for continuing in our present inefficient condition.

J. S. R.

TO CORRESPONDENTS.

Received.—Capt. N., H. E. H., J. J. S., C. G. G., G. B., R. A. E. S., T. M., J. S. R., Inquirer, Dr. E., Nauticus (the question of geology *v.* Genesis is rather to speculative for the M.M., we have received several letters on the question), W. B., E. B., P. J. & Co., J. H. D., Capt. S., J. D., W. W., R. E., J. H. M., J. S.

Correspondence.

[*We do not hold ourselves responsible for the statements of our Correspondents.*]

SHIPS WITH WOODEN BOTTOMS AND IRON TOP SIDES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—This extraordinary combination of wood and iron for naval structures is again brought prominently under the notice of the public. If any reliance is to be placed on the *Times*, it is the intention of the Government to construct a whole fleet of vessels of this description. We really do not know what to believe or disbelieve of the revelations made under the head of "Naval and Military Intelligence," in that journal. The statements therein published assume the style and tone of official reports; but they so often prove to be unfounded, they must be received with caution. On this occasion, however, there is a precision of language and confidence of assertion which seem to leave no room for doubt. "This new system (it is announced), thus promptly and *fully adopted* by the decision of the Admiralty, is looked upon in the Royal Dockyards *most favourably* from the fact that the *entire re-construction* of the navy may be effected out of the materials originally converted for the wooden vessels now condemned. As numerous timber vessels are far advanced in many of the Royal yards, and the works have been suspended, we are now able, on *Mr. Reed's principle*, to throw the whole strength of the dockyards upon them anew, and can thus develope a *large iron-plated fleet of sea-going ships*, of moderate dimensions, in a very short time, and with our ordinary expenditure."

Mr. Reed himself, in a letter to the *Times*, admits the soft impeachment. He veils his confirmation of the statement in modest language. "If I am fortunate enough (he writes) to become to any extent instrumental in effecting the great result which your correspondent here so kindly predict for me;" and then adds, "the intentions of the Admiralty to be gathered (from a former letter of his) were manifest enough;" so that, however ambiguous the expressions may appear, Mr. Reed does not contradict the *Times* report, which he undoubtedly would do if it were not true. On the contrary, he anticipates with pride the "*great result.*"

We treat this report, therefore, as authentic, and having on a former occasion drawn attention to the subject, we conceive it to be our duty to make some comments upon it.

In the intention here so strongly manifested there is a fixed and persistent determination to continue the construction of certain classes of wooden vessels, on a large scale. Notwithstanding the strong convictions of the most eminent shipbuilders, and the admissions of the Admiralty itself in favour of iron, in the face of a mass of evidence all tending to condemn wood as a material for ships of war, the *entire reconstruction of the navy in wood* is contemplated. This intelligence is astounding, and cannot fail to excite a sensation in the House of Commons. It is not long since the First Lord and the Secretary of the Admiralty stated, in their places, that only one thing was wanting to determine that every vessel in the navy, small or large, should be of iron and iron only, and that thing was to be able to copper their bottoms. About the same time it was announced that plans for carrying out that operation were under consideration, and a special committee, of which Mr. Laird was a member, was appointed to examine them. The subject was also investigated by the Iron Plate Committee, who recommended certain plans for trial. We are informed that there is no difficulty in covering an iron ship's bottom with wood-doubling, which would not only admit of sheathing her with copper in the ordinary way, but would protect and greatly strengthen her bottom. This removes the only objection to small iron vessels, which Mr. Reed can adduce as a reason for adopting his plan. "The construction of wooden bottoms was," he says, "advocated by me on the important ground that vessels with their unprotected iron bottoms are unfit to perform the services which we require of our smaller ships of war." But if strong wooden doubling coppered be securely fastened outside the iron bottom it will no longer be *unprotected*. It will be stronger than any mere wooden bottom, and the last pretence for Mr. Reed's plan will be removed.

The determined spirit shown by Government to persist in using wood for the Navy is inconceivable, and it makes one heartily echo Sir M. Peto's sentiment, "that he would be delighted to vote a handsome retiring pension to every person not required for the fleet of the future." Mr. Reed chooses to misunderstand this, as referring to the workmen employed in the dockyards, and takes credit for a compassionate feeling in their favour; but everybody else knows that the member for Finsbury had in his mind, not the dockyard artizans, but the officials, of whom Mr. Reed has become one, who are partizans of wood and "not *required* for the (iron) fleet of the future." This language is plain enough; it means a reconstruction of the *Controller's department*.

A Civilian.

◆

DIE-ENGRAVING MACHINE.

Sir,—There appeared in your magazine some time since, several interesting and valuable papers on the various processes concerned in the production of the coins of the realm, but no account was given of the manner in which the dies are prepared by the engraver of the Mint. In the absence of such information, the writer of your articles on the International Exhibition has been led to refer to an instrument for engraving dies, as though it were quite a new application of machinery. The very ancient lathe, as old at least as the time of Sir Isaac Newton, and figured in the last century in the French Manual of Turning, has for many years been employed at the Mint in making the effigies of the coins, reduced copies from models one-half or one-third the size of life. In this manner responsibility, in the artistic sense, may rest upon another person than the engraver. For instance, Sir Francis Chantrey modelled the bas-relief portrait of William the Fourth, but the late Mr. Wyon himself modelled that of the Queen. A cast of the model is taken in metal (in order to withstand the tracer), which is then fixed in the machine as the original, from which as many copies are made of the various sizes required, as may be wanted. These copies are made in steel and in *relief*, and therefore after they have been finished by the engraver and hardened and tempered (I believe a very slight temper is given to them) they serve as punches to produce the working dies. The cutter of the machine acts like a tool in turning, and is therefore incapable of cutting in intaglio. It does its work pretty well, but is liable to make rather deep scratches, arising from steel particles clogging the fine point of the tool occasionally. It slurs over the re-entering angles, and as the point wears the accuracy of the copy is affected. The process also is tedious. The late Mr. Wyon, sen., consulted me on the propriety of applying my sculpturing machine to the purpose, not only for the sake of obtaining a more perfect copy, but the option also of working in intaglio. I did not encourage the idea, because, as I represented to him, he, as an artist—and he was a true artist—ought to have a certain scope for the display of his own artistic feeling, in the way of an intensifying manipulation, as called for by the very small scale of the engraving. The carver of busts in marble knows what this means, though demanded here, not by minuteness of size, but by the transparency of the material. All that the die sinker requires in the way of aid is accuracy of outline and the relative heights from the surface ground. But what Mr. Wyon wished to obtain was an object to which he would have subordinated artistic feeling, namely, the integrity of the coin in regard to a given standard of portraiture for all the copies in all the sizes required. It was in this point of view that, many years subsequently, I applied my process to the production of dies for post-office stamps, and illustrated my proposal by a small machine with rotating cylinders, mounted with punches and dies, which threw off stamps with immense rapidity. A machine of this kind of very moderate size (within the compass of a cubic foot) would produce millions of stamps in a day. The Lords of the Treasury did not adopt my plan, possibly because they preferred perfectly flat to slightly embossed stamps, but I received from them one of the rewards granted to the successful competitors. You will now perceive that die engraving by means of a machine is not a new invention. I am, Sir, yours, &c.,

Benjamin Cheverton.

P.S. Allow me to notice a typographic error near the end of my last communication, where, instead of saying "that the wave line surges," it should have been that it "merges into a straight line at the surface of the water." And I may as well mention, that subsequent calculation informs me that the alternate ribs of wood and iron need not, and indeed that for my purpose it would be better, that they should not be of equal weights.

◆

MR. CHEVERTON'S VESSEL.

Sir,—Mr. Scott Russell has been for some years pushing forward an admirable principle of his in shipbuilding, which he aptly terms "the longitudinal method of shipbuilding." I heard him refer to it in 1857, but it seems he dared not bring it forward in the shape of a paper until 1862, and even then the *vis inertiæ* it met with was almost crushing. I would, however, advise Mr. C. to make himself acquainted with it. I need not say it is in direct opposition to the mode proposed by Mr. Cheverton in his lengthy letter.

While shipbuilders are scheming to obtain longitudinal strength, Mr. Cheverton proposes a mode of shipbuilding which could not possibly hold together, and which puts one in mind of a sea serpent.

I am, Sir, your obedient servant,
T. Moy.

1 Clifford's Inn, June 24, 1862.

◆

THE STRAIGHT LINE *V.* THE WAVE LINE FOR VESSELS.

Sir,—Mr. Cheverton will find he is in error as to the assumptions upon which the wave line system is based, if he will take the trouble to refresh his memory by referring to the many published arguments upon the subject. Water is *not* treated by wave line theorists as though it were one entire body. The curves used are *not* parabolic curves. The wave line system *is* more in conformity to the actual phenomena of the case than any other theory.

Mr. C.'s illustration of a feather is inapt; a falling feather is subject to exactly the same laws of motion as a falling cannon ball; the feather merely attains uniform motion in a shorter distance, and both illustrations are inapplicable to the case. I presume Mr. C. means by the *straight line* idea, to form vessels with simple wedge-shaped bows. He is quite welcome to all the credit he claims with respect to the *novelty* of the idea. I presume also that Mr. C. will admit that the *sharper* the wedge, and consequently the smaller the angles, the less the resistance. Now, the wave line system does away with *all* angles!

I am, Sir, yours, &c.,
T. Moy.

1 Clifford's Inn, 25th June, 1862.

Gossip.

◆

At the moment of the destruction of the city of Pompeii by an eruption of Mount Vesuvius, in the year A.D. 79, a theatrical representation was being given in the amphitheatre there. Taking advantage of this affecting historical reminiscence, a speculator, named Langini, has just completed the construction of a theatre on part of the ruins of the destroyed city. The opening of the theatre he announces in the following terms:—"After a lapse of nearly eighteen hundred years the Theatre of Pompeii will be re-opened with 'La Figlia del Reggimento.' I solicit from the nobility and gentry a continuance of the favour bestowed on my predecessor, Marcus Quintus Martius, and beg to assure you that I shall make every effort to equal the rare qualities he displayed during his management."

Another discovery threatens to change our railway plant, perhaps our railway system. This time it is not the motive power. M. Girard, under the patronage of the Emperor, has constructed an experimental railway, on which the carriages are impelled after the manner of a sledge hammer. The runners of the sledges rest on a species of hollow clogs, between which and the rails water is introduced. Thus the carriages slide on a thin layer of water, and friction is almost annihilated. The success of the experimental railway is stated to be so decided, that the Emperor has appointed a Commission to report on the system.

M. Grivel Jeune, a French engineer, has recently patented two inventions for preventing railway accidents, and they are now on view at the Whittington Club. They are thus described by the inventor:—"First, a self-acting apparatus, indicating to the driver of a train if the line is clear, and if a preceding train is at a proper distance or not; and warning him of same in any weather or season." Second—"A new description of brake, to stop the disastrous results of a locomotive mounting an incline to which carriages and trucks are attached, paralysing the rupture of the coupling chains, arising either from the too great weight, or from flaws in the manufacture." The action of the inventions is explained by means of skilfully executed models and drawings, and the experiments made were quite successful. Considering that so much diversity of opinion exists among professional men in regard to railway signals and brakes, it would, of course, be out of place for us to pronounce a decided opinion on M. Grivel's inventions. We may state, however, that they at least seem to have as much merit as renders them worthy of a careful investigation from the railway authorities.

A novel trawling experiment will take place in the course of a few days, by a steam fishing vessel lately fitted up at Leith. Her trawling gear, which is very heavy, is to be wound up by a capstan driven by steam power, and all living fish taken will be put into a well having a constant circulation of water, and there the fish will be kept alive until brought to market.

A discovery has just been made of some interesting documents relative to Moliére; they were found at the house of a notary by M. Eudore Soulié, conservator of the museum at Versailles. Among those papers is a complete inventory of the apartment of Moliére, taken after his death. The bed, owing to the rich carving with which it was ornamented, is estimated at not less than 2,000 livres, an enormous sum at that period.

The project of the Paris Permanent Universal Exhibition has received the approbation of Napoleon III. and the Ministers of Finance. Applications for space must be made on or before the 20th July next, to Messrs. J. Studdy, Leigh, & Co., of Leadenhall-street, who are the appointed agents for Great Britain. The rental for goods or products of the first class, which will comprise all products and manufactures, whether open or in glass cases, will be 50 francs or £2 per annum per square metre; and for the second class, to which wall surface will be devoted, will be 25 francs or £1 per annum per square metre of wall space. Five square metres are equal to six square yards English.

The *Newcastle Daily Chronicle* states that Mr. T Cousins, of New Hartley, with the assistance of Mr Granger, of Delaval, a most ingenious young man, has prepared a model of the shaft of Hartley New Pit, with the yard seam, in the condition it was in immediately after the accident. Mr. Cousins lost two sons in the pit, and was amongst the first of the Hartley men who ventured down the shaft in search of Watson and his companion, and who subsequently explored the yard seam with Mr. Humble and Mr. Hall, after "Cockney Jim" came up. The shaft is modelled in a glass tube, and represents the pumps, the broken timber in it, the high seam, the dark head, the engine drift, &c., with the broken timber, the smashed cage, and Watson and the men as they were situated after the beam fell down the shaft. The yard seam and workings are well described, and the model is the only one that has been produced that gives anything like an adequate notion of the shaft and the pit after the accident occurred. Mr. Carr, Mr. Humble, and all who have examined it, speak highly of its accuracy; Mr. Coulson is exhibiting it in a shop in Tyne Street, North Shields; and all who wish to form an idea of the horrors that the pitmen and sinkers had to encounter in working their way to the yard seam, should inspect it, as it is perfectly truthful in detail.

On Tuesday morning last, the engineers and contractors connected with the Metropolitan Railway and the Metropolitan and various Boards of Works, decided upon altering the plan for the construction of the new channel for the Fleet sewer, which instead of passing, as determined upon on Monday, in a direct line through the valley of the Fleet, and nearly on the site of the original bed, a curve will be formed at the corner of Castle-street and Victoria-street. The trench, taking an easterly direction across Victoria-street, and, passing beneath the railway works, will form a junction with the main sewer at a point nearly opposite Bit-court, Turnmill-street. During Tuesday very rapid progress was made in the excavation, which between Vine-street and Castle-street is completed to the depth of ten feet from the surface; and at night upwards of 300 navvies were set to work, and relieved by a similar number every eight hours. By the unceasing efforts of Mr. Dethick it was expected that the junction would be completed on Thursday.

The process of testing the iron supplied by the contractors at Chatham Dockyard, for the Achilles, 50, building at that establishment, has been carried on for the last few days in the testing-house of the Dockyard, and has resulted in nearly 100 tons, chiefly of five-eights plate-iron, being rejected as not reaching the standard of excellence laid down by the Admiralty. For some time the iron received at Chatham was of a very superior quality, but lately it has proved rather inferior. In consequence considerable quantities have been rejected, by which the works have been greatly retarded. This will cause a serious delay in the construction of the ship, as only a very small number of platers are now employed, owing to the scarcity of good iron. There are now rather less than 500 hands employed on the Achilles, but at least double that number will be required to be placed on her if she is to be completed by the time originally fixed upon by the Admiralty. A slight alteration is to be made in the plans, so as to obtain increased strength, in order to enable the frigate to sustain the additional weight which will be thrown on her in having the massive armour plates carried from stem to stern, and not simply along her broadsides as was at first intended, this arrangement rendering her completely invulnerable, as no part will be left exposed to shot.

By the terms of a convention just concluded the expenses of the great tunnel through Mount Cenis is to be defrayed proportionately by the French and Italian Government and the Victor Emmanuel Railway Company. The French Government is to contribute a sum not exceeding 760,000*l*., and the Victor Emmanuel a sum of 800,000*l*., interest being guaranteed on the latter at the rate of 4½ per cent. The Italian Government is to undertake the execution of the works and find the remainder of the requisite capital. If the works are concluded in less than 15 years from January last the French Government is to give an additional subvention of 24,000*l*. upon every year saved out of the 15. The works are to be measured up periodically, and interest at the rate of five per cent. paid by the French Government to the Italian Government on the expenditure incurred so far.

On Tuesday last the great engine built for land service at London fires was publicly tested in the presence of a large number of scientific gentlemen at the canal adjoining the Great Northern Railway, King's-cross. The first trial, which lasted from a quarter of an hour to twenty minutes, showed that the water discharged by the engine was projected (steam having been previously got up at ninety lbs. to the square inch, in eleven minutes and thirty seconds), a distance of 160 feet, and that went through an inch and a-half nose pipe—or what is better known as a nozzle. From one inch and a three-eighths nose pipe the water was projected a distance of 185 feet. Two branches were next attached, and the water was thrown from each jet 180 feet, the power of the engine being 30-horse power. The machine, which is termed the "Deluge," was placed in the Great International Exhibition on Wednesday, space having been specially set apart for her reception. The water discharged, as gauged by those present, was at the rate of 480 gallons per minute.

Coal Tar made Picturesque.—If coal be regarded as the product of ancient sun-force, then the "light of other days," which has not faded, may be reproduced in colour of every shade and hue. Every one knows that when coal is distilled gas is produced, is carried away and collected, and that among the refuse products of the process is coal, which was formerly sold at a very low price. Coal tar is a very complicated body, and, when carefully distilled, it yields certain volatile fluids, smelling more or less of tar, among which is a naptha called "benzole." Small bottles of benzole are sold for removing grease stains under the name of *benzine collas*. Benzole is next acted on by nitric acid, and by that means changed into nitro-benzole—a liquid having so exactly the smell of the essential oil of bitter almonds that it is substituted for it in the manufacture of almond soaps and of cheap perfumery. When iron filings and acetic acid act upon the nitric benzole it is changed into aniline, and this aniline when acted on by arsenic acid, bichromate of potassium, permangamic acid, stannic chloride, &c., yields a great variety of very beautiful colours. These coal-tar dyes are a characteristic feature of the Exhibition. In Perkin's case the visitor will see a cylinder of solid aniline purple, which could easily be carried under the arm. It is worth at least £[illegible], and required for its production the tar obtained from 2,000 tons of coal. It is in tinctorial potentiality equal to 100 miles of calico. Thus are we reminded that death in nature is but new life. Force is, indeed, indestructible; form alone it is which changes. The actual elements caught up from the air millions of years ago, and then quickened into vegetable life by the sun that shone on earlier scenes than Eden, are now delighting the eye and gratifying the taste. The elements of the decayed forests of a pre-Adamite earth are quickened in 1862, and, re-assembling, show that "a thing of beauty is a joy for ever."

Digitized by Google

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgment:—

Steam Engines, &c., 3057, 3065, 3120.
Boilers and their Furnaces, &c., 3123, 3126.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3060, 3117, 3133.
Ships and Boats, including their fittings, 3068, 3086, 3088, 3111, 3129, 3130, 3132.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 3102.
Food and Beverages, including apparatus for preparing food for men and animals, 3069, 3118, 3127.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3075, 3089, 3091, 3106, 3110, 3122, 3136.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c. 3070, 3104.
Lighting, Heating, and Ventilating, 3073, 3090, 3124.
Furniture and Apparel, including household utensils time-keepers, jewellery, musical instruments, &c., 3059, 3061, 3067, 3071, 3085, 3087, 3093, 3095, 3098, 3099, 3105, 3107, 3113, 3114, 3121, 3134, 3137.
Metals, including apparatus for their manufacture, 3058, 3092, 3108, 3116.
Chemistry and Photography, 3076, 3080.
Electrical Apparatus, 3074, 3078, 3100, 3109.
Warfare, 3056, 3062, 3072, 3097, 3119.
Letter-Press Printing, &c., *None.*
Miscellaneous, 3063, 3064, 3066, 3077, 3079, 3081, 3082, 3083, 3084, 3094, 3096, 3101, 3103, 3112, 3115, 3125, 3128, 3131, 3135.

3056. E. D. Lekly, T. T. Wells, and G. A. Phillips. *Capping percussion fire-arms.* Dated Dec. 6, 1861.

The inventor makes use of at outer casing containing a trough in which the caps are placed; a spring acting on a piston or plunger forces the caps to the mouth of the trough, which is preferably rectangular, and has at its extremity a pair of tweezers or nippers which prevent the escape of the caps, and keep the first cap of the series within the trough just over a hole in the bottom of it corresponding in size with the nipple of the gun, and on the instrument being removed, the springs give way, allowing the cap on the nipple to pass between them; the spring piston in the rear forces the row of the caps towards them, and the same action repeated. *Patent abandoned.*

3057. A. R. & W. Woodward. *Improved arrangements of compound steam engines.* Dated Dec. 6, 1861.

This consists, 1, in the arrangement and combination of a vibratory or fixed cylinder placed between the pillars of a beam engine, or between the pillars and the wall of the engine house, thereby requiring no additional foundation or engine house. The said vibrating or fixed cylinder is used as an auxiliary or pusher to the beam engine, or it may act as a separate engine. 2. In the arrangement and application of a vibratory or fixed cylinder to a horizontal engine to act as an auxiliary or pusher to the said engine. 3. In the improved arrangement and construction of the framework for carrying the vibrating or fixed cylinder, so that the power will be contained within the said framework. *Patent abandoned.*

3058. J. & W. N. Bailey. *Improvements in apparatus for indicating the pressure of steam and gases, the amount of vacuum, the flow of fluids, the weight of materials, and the speed of bodies either revolving or traversing, and also the employment of aluminium or its alloys in the manufacture of the same.* Dated Dec. 6, 1861.

In one of these arrangements of steam pressure and weight gauges the patentees use a knife edge crank or pivot attached to a weight or its equivalent, so as to act as a lever. They use the ordinary India rubber or metallic diaphragm acting against a piston in the usual way. The piston and weight are connected together by a link, having at the bottom a semicircular bearing upon which the knife edged pivot rests, so that, when the piston rises or falls, the pivot will have a delicate motion on the bearing of the link, and thereby ensure but little friction. The invention comprises much other detail, which we cannot give space to here. *Patent completed.*

3059. C. Craddock. *An improved system or method of cutting out ladies' dresses.* Dated Dec. 6, 1861.

This is intended to facilitate the cutting out of the bodies of ladies' dresses by merely taking three dimensions. 1. The size round the chest and shoulders. 2. The measure round the waist, and 3. The length of the side seam taken from close under the arm to the natural waist of the figure. *Patent abandoned.*

3060. J. D. Napier. *Improvements in brakes.* (A communication.) Dated Dec. 6, 1861.

The patentee claims the jointing of the ends of a friction brake strap upon the actuating lever at different distances from the centre of motion of the lever, and so that the turning of the lever causes both ends of the strap to move in the same direction, or in an equivalent manner, and the using of such arrangement as a self-acting appliance for preventing backward motion. *Patent completed.*

3061. E. Collier. *Improvements in covering for the feet and legs.* Dated Dec. 6, 1861.

This consists in forming the leg of a boot to represent a gaiter or legging, so that when required for that purpose it can be worn outside the trowsers. *Patent abandoned.*

3062. F. Vetterlin. *Improvements in breech-loading ordnance, and the projectiles to be used therewith, and with small-arms.* Dated Dec. 6, 1861.

In constructing breech-loading ordnance, the inventor forms the breech-end of the gun of an increased thickness. At right angles to the longitudinal axis of the piece he forms a horizontal opening through the chamber at a suitable distance from the rear end, such opening being of greater depth than the diameter of the chamber, and of such a width in the direction of the axis as will enable two pieces of metal to be inserted therein. For stopping or closing the breech, as well as guiding the cartridge into its proper place in the chamber, and preventing the abrasion which would otherwise take place against the sharp edges of the horizontal opening or crossway, he forms two blocking pieces of such a length as will enable a circular hole or opening to be bored at one end of each, of the same diameter as the chamber, and when the charge has been entered and driven home, these blocking pieces being slid back or across into such position as to present a portion of their surface at about the middle of their length to the end of the chamber or space devoted to the reception of the projectile and its explosive charge, so that the breech is for the time effectually closed, and the escape of gas prevented. For smooth-bores he forms a projectile, whether conical, pointed, rounded, or flat-headed, with the body recessed, or of a reel-like form, and he winds thereon a layer or layers of rope or twisted straws to such a diameter as will fill the chamber or bore, and by means of a groove or recess around the edge of the after flange of the projectile, he secures the cartridge or case containing the explosive charge. *Patent completed.*

3063. W. Smith. *Improvements in the construction of horse-hoes.* Dated Dec. 6, 1861.

Here the inventor makes the hoe-bars with double flanges (thus —1), and the lever stems he notches to fit on to the double flanges. The hoe stems are secured to their bars by clips formed with two eyes to receive the stem, and a binding screw tapped into the stem bears against the side of the bar, thus holding the notched stem close up to the flanges. The notches being on the stems allows of the adjustment of the former at any required distance apart, and permits also of their being fitted to either side of the bars. There are other features included. *Patent abandoned.*

3064. J. Howard. *An improvement in the construction of bag-making machines.* Dated Nov. 6, 1861.

Here, to prevent the accumulation which is caused by the tine barrels tossing the grass forwards, and causing it to lodge on the frame, the inventor obtains a self-acting discharge of such lodgments before they add materially, as they do at present, to the weight of the implement. *Patent abandoned.*

3065. H. G. Schramm. *Improvements in rotary engines and pumps* Dated Dec. 6, 1861.

Here an outer cylinder is employed with two end covers suitably constructed to receive a shaft or axis through their centre, the passage through the covers being made fluid-tight, as is well understood. On the shaft or axis is fixed a cylinder, suitably formed for receiving hinged pistons or valves at its periphery, and on the inner surface of one or both covers of the main or outer cylinder grooves or guides are formed to draw or move the hinged pistons or valves in towards the cylinder to which they are hinged, and to move them outwards against the inner surface of the main or outer cylinder as required, the valves or pistons being arranged to move into and form recesses in the inner or rotating cylinder. Each valve or piston is hinged or attached to the inner rotating cylinder at a distance from the recess into and from which it is moved, a curved plate perforated with holes being used for this purpose, one end of the curved plate being hinged to the rotating cylinder, whilst the other end of the plate projects beyond, is fixed to, and forms part of, the valve or piston; and it is this end of the curved plate which presses against the inner surface of the main cylinder, in order to keep the valve or piston fluid-tight. The ends of the pistons or valves work against the end covers of the main cylinder. The curved plate, when its piston or valve is within the recess of the rotating or inner cylinder, fits in a recess formed in the surface of that cylinder, so that when that part of the cylinder passes in contact with the stop or inner projection which is interposed between the inlet and outlet passages, it acts as part of the surface of the inner or rotating cylinder. When used for a rotatory pump, motion is given to the shaft or axis, and the pump is furnished with an outlet and an inlet pipe, the inlet being in connection with a suction pipe, and having a valve in it opening inwards. *Patent completed.*

3066. J. J. Russell, and B. L. Brown. *Improvements in apparatus used in the manufacture of paper tubes.* Dated Dec. 6, 1861.

For the purposes of this invention the dies used when drawing tubes are so constructed and worked, that the diameter of the dies is constantly varying as a tube is drawn through them. The dies are made to move progressively, so as continually to present a different section of opening, whilst the tube is drawn through such varying openings at a speed greater than the surface speed which is given to the rollers, or to the section of rollers in which the grooves are made. The rollers or sections of rollers are geared together or worked so that the groove of the one is kept correctly to correspond with the groove in the other. The arrangement of draw bench or machinery used for drawing the tubes through the dies may be varied. *Patent completed.*

3067. T. Lawes. *Improvements in the manufacture of quilts and coverlets.* Dated Dec. 7, 1861.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

3068. G Clark. *Improvements in the use, application, and manufacture of iron or steel, as armour for ships or batteries.* Dated Dec. 7, 1861.

This invention will be specially noticed in a future number of this journal. *Patent completed.*

3069. R. Jolley. *An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases, for manufacturing, medical, or domestic purposes, and for preserving liquids and solids alimentary or otherwise.* Dated Dec. 7, 1861.

This apparatus is made with double or single doors, lids, and covers to shut air-tight, and is wholly constructed upon air-tight and non-conducting principles, with valves to let air in or out, as may be required. In its manufacture the patentee uses a new combination of fibrous, pulpy, and waterproof materials, for preventing the transmission of heat, cold, air, or moisture. *Patent completed.*

3070. G. T. Bladon. *Improvements in chimney tops for the prevention of down draughts in chimneys.* Dated Dec. 7, 1861.

The inventor forms the chimney of a rectangular form, by preference, and covers in the upper part. In each side he forms a long opening of, say, half the breadth of the sides, and extending throughout the greater part of the height; on these openings he applies external flaps, which are hinged at top, and hang so as entirely to close the openings if pressed close to the sides. He connects the opposite flaps in pairs by a connecting rod, the length of which is such that each flap is pressed outwards, and held at bottom about three inches from the side of the chimney top, if uninfluenced by any pressure; but if any pressure of wind takes place on the one flap it is pressed closer, at the same time thrusting the opposite flap further off, and making a larger egress for the smoke thereat; very slight pressure of the wind closes the one entirely. *Patent abandoned.*

3071. D. May. *An improved method of securing scarfs and similar articles to the neck.* Dated Dec. 7, 1861.

This invention consists in attaching a rigid material, such as card or mill-board, to a part of the scarf or tie, the said board being shaped at top to fit the throat, and in sewing or fastening to the said board or the material covering it, a piece of elastic web terminating at top in a loop. This loop is to be passed over the shirt or collar button, when the card or mill-board with the material covering it will be held up against the throat of the wearer, and the scarf thus secured. No part of the scarf or tie extends round the neck. For washing materials the card or mill-board is capable of being removed. *Patent abandoned.*

3072. W. N. Hutchinson. *Improvements in projectiles and ordnance and in apparatus to be used therewith.* Dated Dec. 7, 1861.

This invention relates to a projectile of a concentric discoidal form, and to ordnance to be used for discharging the same, whereby increased range, greater accuracy of aim, and increased penetrating power are obtained, combined with lightness and economy. The projectile may have its circumference or periphery either bevilled on both sides, so as to present a sharp edge, or made flat, and of the same width as the minor axis of the disc. This projectile can be made solid or hollow, and is applicable to shells of all kinds, and from the peculiar mode of firing the same is particularly well adapted to be used as red-hot shot. The discoidal projectile is intended to be forced from the mouth of a short chambered or unchambered barrel, the length of which need not be much more than is sufficient to contain the heaviest charge of powder to be used. The sides of the mouth of the barrel may be expanded to conform partly to the discoidal shape of the projectile, and they are prolonged beyond the actual muzzle of the gun, so as to form a space for the reception of the shot, and in order that the expanding gas thus partially restrained may act the longer on the starting projectile. The discoidal projectile is inserted edgewise, either in a vertical or horizontal plane, into the mouth or muzzle of the gun, and the mouth or muzzle of the gun is, as before stated, shaped so as to correspond to the edge of the shot which fits up against the wad. The shot is held in its place in the mouth of the gun by a cord or band of suitable strength passing round it, which cord is broken or severed by the firing of the gun. The barrel itself is contained within a wrought iron cradle or frame, supported upon a suitable stand resting on a platform which will admit of the cradle and barrel pivotting or turning into a convenient position for receiving the shot, and will also admit of the cradle with true barrel being a little raised or lowered, so that the line of fire may be a little above or a little below the geometrical centre of the projectile when the gun is loaded. The platform extends beyond the mouth of the gun, and is capable of the lateral or vertical adjustments required for properly pointing the gun. The front portion of the platform carries guiding bars supported in suitable standards, which bars serve to guide the shot on leaving the gun. A rotary motion on its inner axis is imparted to the projectile if it be so adjusted in the gun that the line of fire be slightly above or below the centre of gravity or the geometrical centre of the shot. The patentee determines the centre of gravity of the discoidal shot by means of a machine consisting of vertical slides, upon which the shot is laid horizontally and balanced on different diametrical lines, hence the exact segment in which the centre of gravity lies can be readily determined. In order to counteract or deaden the recoil of the gun, a spring may be placed between the breech end thereof and the rear end of the cradle, and the barrel may lie upon india-rubber in its cradle. This cradle is attached to the front part of the frame or platform by india-rubber bands from its rear, the cradle with the true barrel being in that case allowed to recoil up an inclined plane, while the guiding bars remain stationary on their platform. When very large projectiles are to be thrown, the muzzle of the gun may be made to enter the projectile, instead of embracing it. In such case, should the projectile be hollow or a shell, that part of the periphery where the aperture is left for the muzzle of the gun would require to be strengthened. These forms of guns and projectiles are equally applicable to heavy ordnance and light field pieces, and sometimes in field practice he uses a projectile composed of a number of thin plates, fashioned or curved like a boomerang, placed side by side, which will separate on being fired. *Patent completed.*

3073. H. W. Bristow. *Improvements in the manufacture or production of candles.* (A communication.) Dated Dec. 7, 1861.

This consists, 1, in the manufacture and the production of candles by combining together japan wax and the product which is obtained in subjecting tallow to the treatment hereafter described. It is proposed to effect the partial saponification of tallow by a solution of an alkali, or of an alkaline carbonate, such as potash or soda, or their carbonates. By preference the inventor uses a solution of carbonate of potash containing about one-tenth part by weight of carbonate of potash. When a partial saponification of the tallow has been effected by an alkaline solution or the application of heat in the usual way, the resulting soapy compounds are decomposed by an acid, hydrochloric acid being preferred. The product resulting is allowed to cool, and is submitted to pressure in a hydraulic or other press. *Patent abandoned.*

3074. T. Fearn and T. Cox, Jun. *The application of certain electro deposits in the coating or finishing of the stretcher ribs and other metal portions of umbrellas and parasols.* Dated Dec. 7, 1861.

This consists in coating or covering (by the agency of electricity) the metal portions of umbrellas and parasols with tin, or alloys that will readily mix and amalgamate with tin, so as not materially to affect the white or bright colour natural to tin so deposited; nevertheless, the inventors purpose that tin shall form the principal basis of the deposit. The metal portions of umbrellas, &c., thus treated will not be liable to corrode or oxidize. *Patent abandoned.*

3075. T. Mellodew, C. W. Kesselmeyer and J. M. Worrall. *Improvements in dyeing and printing certain descriptions of woven fabrics.* Dated Dec. 7, 1861.

This relates to a previous patent, dated 17th June, 1861 (No. 1547), and consists in extending the method of printing or dyeing described in the specification of the said patent to such fabrics with a silk face and cotton or linen back as are not intended to be cut for the production of a plush or pile fabric, but in which a plush or nap may be produced by raising the silk surface instead of cutting open the silk threads of such surface. The patentees claim, 1, the application of the solution of iron or other mordant by the process of padding to the back only of such fabrics, as aforesaid. 2. The use for the above-mentioned fabrics of yarn of cotton, or other such material, as aforesaid, which is proposed only for dyeing by the application of a mordant. *Patent completed.*

3076. B. W. Gerland. *Improvements in the manufacture of sulphate of copper and other salts of the same metal.* Dated Dec. 7, 1861.

The patentee claims, 1, the manufacture of sulphate and other salts of copper from that description of ore known as malachite or other carbonate of copper, and also of oxide of copper for precipitating iron and other metals from cupreous solutions. *Patent completed.*

3077. R. Fanner. *Machinery for cementing the points of envelopes.* Dated Dec. 9, 1861.

Provisional protection has not been allowed for this invention.

3078. C. F. Varley. *Improvements in electric telegraphs.* Dated Dec. 9, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3079. M. A. F. Mennons. *Improved natatory apparatus.* (A communication.) Dated Nov. 9, 1861

This invention is not described apart from the drawings. *Patent completed.*

3080. M. A. F. Mennons. *A new or improved application of microscopic photography.* (A communication). Dated Dec. 9, 1861.

This consists in the application of microscopic photographs and lenses or lenticular surfaces to such precious stones and imitations thereof as possess a sufficient degree of transparency to allow the passage of the visual rays. *Patent completed.*

3081. *Improvements in the production of relief designs on metallic surfaces for general printing, gaufering, and embossing purposes.* (A communication.) Dated Dec. 9, 1861.

We cannot here give space to the voluminous details of this invention. *Patent abandoned.*

3082. J. Fordeau. *Improvements in treating linseed oil.* Dated Dec. 9, 1861.

This consists in passing, driving, or drawing, heated atmospheric air, or superheated or free steam, through linseed oil, whereby the oil is purified and improved in various ways. *Patent completed.*

3083. R. A. Brooman. *Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatus to be employed therein.* (A communication.) Dated Dec. 9, 1861.

The nature of this invention consists, 1, in the hydration or moistening of common air or other elastic fluids to the extent of their capacity to retain and transport the watery particles in the condition of vapour when the same are to be employed for purposes of motive power in combination with heated surfaces. 2. In the circulation of the fluids thus treated through heated chambers or passages under conditions that will allow of the dilation or expansion of the whole volume at each stroke of the engine. 3. In the construction of an engine to be worked by such fluids, in which the cylinder and air pump are combined in one common vessel. 4. In the construction and use of a moveable furnace or fire grate capable of being raised, or lowered, or withdrawn, at pleasure, and simultaneously starting or stopping the engine. 5. In the employment of a reciprocating rotary valve with moveable port lips adjustable by screws to compensate for friction and wear. *Patent completed.*

3084. R. A. Brooman. *An improvement in black-lead pencils.* Dated Dec. 9, 1861.

Provisional protection has not been granted for this invention.

3085. S. W. Silver, and H. Prinola. *Improvements in shoes for horses and other quadrupeds.* Dated Dec. 9, 1861.

This invention consists, 1, in manufacturing shoes entirely of hardened india-rubber, known as ebonite or vulcanite, alone or mixed with metal filings, or particles of metal, or with gritty material, in order to give hardness and durability to the shoe. 2. In lining shoes as at present made with vulcanite or ebonite, in order to prevent the jar to the feet of the animals. And, 3, in forming shoes, whether made of iron and lined or not, with one or more joints to allow of the natural lateral expansion of the hoof. *Patent abandoned.*

3086. W. Mason. *Improvements in applying armours or thick plating to ships and other structures.* Dated Dec. 9, 1861.

Here the upper and lower edges of the armour plates are bevilled, and narrower thicker plates or bars are used with such armour plates, which are also bevilled at their upper and lower edges to correspond with the edges of the armour plates. These narrow and thicker plates or bars are fixed in a direction fore and aft of the ship, so that the bevilled edges of the narrower and thicker plates or bars may overlap the edges of the armour plates. Through bolts are also employed. The inventor places timber between the skin of the ship and the armour plates, and between the timber and the narrow plates or bars he places thin plates of iron of greater width than the narrow plates. At the back of the narrow plates or bars he forms longitudinal grooves to receive the ends of eye bolts, so that on keys or bolts been passed through transversely they will fix the eye bolts to the backs of the narrow plates or bars. *Patent abandoned.*

3087. W. Clark. *Improvements in gloves.* (A communication.) Dated Dec. 9, 1861.

This consists in placing a piece of elastic in the palm of the glove, somewhat in the form of a triangle, the base of which is widened and extends some short distance up on each side. *Patent completed.*

3088. S. Newton. *Improvements in apparatus for steering and stopping vessels.* Dated Dec. 9, 1861.

This consists in the application of plates or surfaces inclined in the sides of ships below the water line, such plates presenting a flush surface with the side of the ship when in the recesses made for their reception. They are made by preference of considerable length, and somewhat wider at one end than at the other. At the base or wider end they are hinged to the ship's side, and from this point they are laid forward in the recesses prepared for their reception, and have chains attached at the free end which are rove through eyes or other gear and laid on deck or otherwise, whereby the surfaces can be extended at right angles, or at any other angles to the ship's side, or hauled close into their respective recesses. *Patent abandoned.*

3089. G. Tear. *Improvements for facilitating the drying of wet or damaged cotton, or wood, or other similar fibrous material.* Dated Dec. 10, 1861.

This consists in placing a layer of wet cotton between suitable open network formed of water-proofed or prepared cord or twine (to prevent rotting), and which is caused to hold the cotton in the required position by strips of wood, inserted through the meshes across the net work. After the nets are filled, it is proposed to suspend them from the ceiling of a room, or upon suitable supports, where a free current of air can circulate around them, or, when convenient, in the open air. *Patent abandoned.*

3090. H. Alexander. *Improvements in turning apparatus for making gas burners.* Dated Dec. 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3091. H. Spencer. *Improvements in machinery or apparatus for spinning and doubling cotton, and other fibrous substances.* Dated Dec. 10, 1861.

This relates, 1, to throstle or doubling frames, and consists in placing hooks, screwed or otherwise fixed, in the front of the thread or guide board, such hooks being bent in an angular form, so that, if the thread or yarn should expand or throw out, it will then come in contact with such hooks, which will prevent making hard waste, and will also prevent breaking the adjoining threads or yarns. The invention also relates to an improvement in the drag in throstle frames, and consists in fixing a slide or slides so as to rise and fall with the lifting or lowering rails or plates. Another improvement is intended to give a more equal drag upon the cloth. The invention further relates to the guide wires of the throstle and doubling frame, and consists in bending and forming such guide wires so that the thread or yarn can be placed in front of the same without having to thread from the back. *Patent abandoned.*

3092. W. F. Stanley. *The use of aluminum for the construction of mathematical instruments used for geometrical drawing, surveying, and nautical purposes, and improvements connected therewith.* Dated Dec. 10, 1861.

This consists in the use of the metal aluminum, or its alloys, for making mathematical instruments. *Patent abandoned.*

3093. J. A. J. Redier. *Some improvements in pocket watches.* Dated Dec. 10, 1861.

This consists in a new construction of the watch case, and in the mechanical arrangement for winding up the watch and setting the hands to the hour, and these objects are effected by means of a projecting stud or knob placed above or in the ring or handle of the watch. The invention is not described apart from the drawings. *Patent completed.*

3094. V. L. Dauzan. *A system of paving.* Dated Dec. 10, 1861.

This consists mainly in the superposition of two roads or ways, one underneath composed of trenches or gutters made of beton and covered with bitumen, serving to conduct the water, &c., into the drains, and sufficiently strong to support the upper way, which is intended for ordinary traffic. The upper road is composed of slabs or flags placed horizontally side by side, with spaces left at certain distances between them for the passage of water, &c., into the drains. The patentee prefers using slabs made of cast-iron frames, having cellular openings or spaces in which are applied, and fixed by bitumen, blocks of sandstone, porphyry, granite, or wood. *Patent completed.*

3095. G. C. Lock. *Improvements in cinder sifters.* Dated Dec. 10, 1861.

This consists of a square or other shaped box, which is fitted internally with a plate or shelf dividing the upper from the lower portion of the box. This shelf is attached horizontally to the inner side of the box, and extends obliquely down towards, but not up to, the back thereof, thereby leaving an opening between the lower edge of the plate and the back of the box to allow the ashes falling upon the plate to slide down and fall beneath it. A little above the oblique shelf is placed a riddle, perforated plate or grating, which occupies the whole area of the box, and is also placed in an oblique direction with its lower edge against the inside of the back of the box. *Patent abandoned*

3096. T. Higgins. *Improved machinery for filling dipping clamps with tapers, match stems, and splints.* Dated Dec. 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3097. W. E. Newton. *Improvements in breech-loading cannons.* (A communication.) Dated Dec. 10, 1861.

This consists in constructing the rear end or back part of cannon or ordnance with a vertical slot, and placing within the same an oblique block, suspended on a horizontal shaft, and made eccentric at its ends to the centre of the shaft, so as to enable the eccentric ends, by an oscillating movement of the shaft, to be brought in such relation to the eccentric surfaces of a moveable breech block at the rear end of the slot as to force and hold a tapering projection or breech pin on the front part of the moveable breech block in the corresponding flared or frustrum of a cone-formed end of the barrel of the gun when fired, and to allow the breech block to be withdrawn to admit of the insertion of a fresh cartridge. This is effected by bringing the long block into a vertical position in its slot, so as to leave room for the breech block to be drawn back. The front end of the moveable breech-piece is provided with a conical copper or soft metal collar, to form a tight joint with the breech end of the bore. *Patent abandoned.*

3098. W. E. Newton. *Improvements in knapsacks.* (A communication.) Dated Dec. 10, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3099. D. Vogl. *Improvements in garments for gentlemen and ladies' wear.* Dated Dec. 10, 1861.

This consists in making garments for gentlemen and ladies' wear in imitation of waistcoats or vests, and fronts of jackets for ladies, so that they shall be fastened behind instead of in front by rigid or elastic straps, or bands, buckles, or other suitable fastenings, the waistcoat, vest, or jacket front being furnished in front with buttons or studs, and with or without button holes, so as to appear similar to an ordinary waistcoat or other front, dispensing entirely with the back thereof; but in cold weather a flap forming the back may be attached by buttons or otherwise, and the straps or bands may be so arranged as to combine a belt with the waistcoat or vest for the use of riflemen and others. *Patent completed.*

3100. J. W. Agnew. *A new or improved electro-voltaic pocket battery.* (Partly a communication.) Dated Dec. 10, 1861.)

This electro voltaic pocket battery is constructed in the following manner:—A series of any number of hollow spiral tubes is formed, composed of zinc, and platinum, silver ribbons or flattened wires, or any other of the heterogeneous metals, insulated from each other by crotchet cord, or other absorbent material, so as to prevent contact between the two metals, and these ribbons or flattened wires and the crotchet cord are regularly and methodically twisted to the right and to the left in alternate tubes, and the tubes are placed horizontally parallel to one another, at a sufficient distance to prevent contact, at their extreme ends, where the metallic ribbons and diverge at right and left angles by the heterogeneous metal of the one crossing that of the other, and sufficiently soldered thereon. This series of tubes together on both sides by a framework composed of slats of glass or other suitable material, coated with dissolved sealing wax, and adhering to narrow strips of gutta percha, or other raw conducting material, connected sides of tubes. The advantage of this construction of battery is that, the tubes being hollow and open from end to end, an immense quantity of electricity is involved by the atmospheric action, and the action of the acids or existing fluids upon their interior as well as external surfaces. *Patent abandoned.*

3101. M. A. F. Mennons. *Improvements in jack machines for moving heavy bodies.* (A communication.) Dated Dec. 11, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3102. H. Tanner, and W. Proctor. *Improvements in the method of applying manure to growing crops, and also in machinery employed for such purpose.* Dated Dec. 1861.

This consists in applying manure to various crops by an implement which, while it supplies the desired quantity of manure, mixes or intermingles the same with the soil. *Patent abandoned.*

3103. W. Clark. *Improvements in stoppering bottles and other vessels.* (A communication.) Dated Dec. 11, 1861.

This is produced by, 1, a glass or porcelain disc, or other hard and impermeable substance. 2. By the interior of the neck of the bottles to be closed on which a disc is placed. 3. By the use of a mastic which stops all crevices or holes which exist in the edges of the neck of the vessel and the glass disc which rests on the said edges. 4. By the use of wax, india-rubber, gutta-percha, wood, cork, &c., which is placed under the glass disc, and which composes the hermetical closing. *Patent abandoned.*

3104. W. C. S. Percy. *Improvements in machinery for*

Digitized by Google

making bricks, tiles, pipes, and other articles formed of plastic materials. Dated Dec. 11, 1861.

We cannot here give space to the details of this invention. *Patent abandoned.*

3105. J. Schloss. *An improvement in forming the leaves of albums and books for containing photographic portraits and views.* (A communication.) Dated Dec. 11, 1861.

In the leaves as now made the pictures are introduced into, and, when required, removed from, each leaf through an aperture or space made or left at the side, top, or bottom, or through a slit made above the top or under the bottom of the window or space made for showing the picture. Now, in this invention, neither such space, aperture, nor slit is made, but the leaves are so put together that the pictures are introduced and removed through the windows themselves. The invention consists in interposing between two sheets of paper, with windows cut therein, and which are intended to form the front and back of a leaf of the album or book, one or two thicknesses of stout paper, equal in size to the window sheets, but without any part removed; then in fixing along the edge of these interposed pieces of paper, and on both sides thereof, a frame or beading of card or mill-board, extending inwards from the edge only about a quarter of an inch, more or less. The two first-named sheets of paper are next attached to the cardboard frames, and the leaf for the album or book is complete. The photographic picture is introduced cornerwise through the window, and is worked into position by pressure of the finger. *Patent completed.*

3106. R. A. Brooman. *A method of treating teazles or thistles to be used in the teazling of cloths and stuffs and otherwise.* (A communication.) Dated Dec. 11, 1861.

The object of this invention is to maintain the natural teazle or thistle, intended to be used in teazing cloths and stuffs, and otherwise, in a perfect state of preservation, to prevent decomposition, and to impart to the hooked ends of its fibres such an extent of resistance as will prevent their turning over at work, while at the same time the flexibility of the fibres is fully preserved. The invention consists in treating the thistles with sulphate of copper, and antiseptic and preserving agent. The process consists in impregnating the fibres with a solution of the sulphate of copper, by immersion, infiltration, and under pressure or otherwise. *Patent completed.*

3107. R. A. Brooman. *Improvements in decorating or printing upon china, porcelain, earthen and the like wares.* (A communication.) Dated Dec. 11, 1861.

This invention consists in taking off upon china and other similar wares prints made upon paper, in as many colours as are necessary to reproduce pictures and delicate designs. Hitherto the ornamenting of china and ceramic wares by the aid of lithography was performed by transferring in dark shades or in one single colour which had subsequently to receive the desired colours by hand. In applying by the means described—lithocromy, or the transfer in many colours to china and similar wares, the choicest designs and paintings are reproduced, and that with economy, rapidity, and perfection. In carrying out this invention, as many printings are required as there are colours in the design to be reproduced, and various operations are necessary. *Patent abandoned.*

3108. W. H. Tooth and W. Yates. *Improvements in the manufacture of iron and steel, and in the machinery, apparatus, or furnaces used therein, and for the production of gas to be employed in such manufacture.* Dated Dec. 11, 1861.

This invention is not described apart from the drawings. patentee claims, 1, the mode of constructing puddling, heating furnaces, viz., constructing the floors or hearths of reheating furnaces of a corrugated form, for the purpose set forth. 2. The use of the ferruginous and aluminous composition set forth, or any mere modification thereof, for making the bricks, linings, and other parts of furnaces or apparatus that are exposed to great heat in the manufacture of iron or steel. 3. The apparatus set forth or any mere modification thereof, for the production of gases to be used in the manufacture of iron and steel. *Patent completed.*

3109. J. Porter. *An improved mode of jointing or connecting telegraph wires, which is also applicable to jointing or connecting signal wires, and other wires or rods.* Dated Dec. 11, 1861.

Here the wires to be jointed or connected are passed through separate conical shaped ferrules or blocks, and a rivet head is then formed at the end of each of the wires. This will prevent the wires from being drawn back out of the ferrules or blocks. Both the ferrules or blocks are hollowed to admit of the wire passing through, and one of them is provided with a male screw and the other with a female screw. Behind the thread of the female screw, and within the ferrule, is a chamber or socket to admit the rivet heads of both the wires. When the two ferrules or blocks are screwed together, the rivet heads of the wires within the socket are pressed or drawn into contact, thereby forming a continuous length of wire or strand, whilst the ferrules or blocks themselves form a close fitting joint. *Patent completed.*

3110. J. Leeming. *Improvements in looms for weaving.* Dated Dec. 11, 1861.

This consists in a method of actuating moveable shuttle boxes, whereby much greater simplicity in detail and reduction in cost of construction are obtained. The invention also consists in means for imparting a variable motion to the cloth roller in looms, according as such roller is increased in diameter by the addition of the cloth. The details of the invention are too voluminous to be quoted here. *Patent completed.*

3111. R. Searle. *Improvements in the treatment, preparation, and combination of metals, used for sheathing ships and marine erections, also for roofing buildings, and other purposes.* Dated Dec. 12, 1861.

The patentee claims, 1, the application of zinc or other metal, treated or amalgamated with mercury, to the sheathing of ships and marine erections, also to building and other purposes. 2. The method of keeping the bottoms of iron ships and vessels sheathed with iron clean, by a weak galvanic current, produced by the application of suitable proportions of copper or brass to their internal or external surface. *Patent completed.*

3112. M. A. F. Mennons. *An improved means of defecating and purifying cane and other saccharine juices.* (A communication.) Dated Dec. 12, 1861.

This consists in the application of albumen to the defecation and purification of cane, beet root, and other saccharine juices. *Patent completed.*

3113. W. Lightfoot. *An improved bridle.* Dated Dec. 12, 1861.

Here the bit acts or causes action, not in the mouth of the horse, but in the nose and under jaw, except in so far as regards snuffle, and acts with any desired severity at the option of and with perfect ease to the rider. The invention is not described apart from the drawings. *Patent completed.*

3114. W. W. Godfrey. *A shield protector for Albert guards.* Dated Dec. 12, 1861.

This fastener or protector consists of a shield, or any other suitable device, combined with a bar or stud, and by a simple arrangement the bar, stud, or other holder, on being slightly turned, will fit or catch into a click or lock, made in or on the shield or other device. *Patent completed.*

3115. W. E. Wiley. *An improvement or improvements in pencil cases and holders for crayons and other solid writing and marking materials, which improvement or improvements may also be applied to crochet needle holders.* Dated Dec. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

3116. R. Mushet. *An improvement or improvements in the manufacture of iron and puddled steel.* Dated Dec. 12, 1861.

This consists in adding to and puddling with ordinary pig iron, cast iron, or refined iron in the puddling furnace, a quantity of titanic pig metal, in order by the said addition of titanic pig metal to improve the quantity of the bar iron, or malleable iron, or puddled steel, which it is intended to produce by puddling the said ordinary pig iron, cast iron, or refined iron, in the puddling furnace. *Patent abandoned.*

3117. W. S. Longridge. *Improvements in railway wheels and tyres.* Dated Dec. 12, 1861.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated March 22, 1862.

807. M. Henry, 84 Fleet-street. Improvements in kilns, ovens, and furnaces. (A communication.)

Dated April 11, 1862.

1051. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in fire-arms. (A communication.)

Dated April 21, 1862.

1151. A. P. Tronchon, 2 Rue Sainte Appoline, Paris. Improvements in the construction of houses, palisades, and other similar constructions.

Dated April 24, 1862.

1205. T. W. Ashby, Stamford, agricultural implement maker. Improved apparatus for obtaining motive power from the wind. (A communication.)

Dated April 30, 1862.

1282. A. H. Fielden, 35 Castle-street, Holborn, commercial traveller. Improvements in show jars, lamps, signals, and lighthouses, and other methods of illumination.

Dated May 9, 1862.

1389. L. D'Aubreville, 60 Boulevart de Strasbourg, Paris, C.E. Improvements in metallic cross sleepers for railways. (A communication.)

Dated May 13, 1862.

1434. J. D. Gavillet, engineer, and J. P. F. Gandon, 26 Rue Leonie, Montmartre, merchant. Improvements in paddle-wheels applied either for propelling steam boats, or as prime movers.

1419. M. Henry, 84 Fleet-street. An improvement in or addition to gloves. (A communication.)

Dated May 17, 1862.

1497. R. W. Sievier, Guildford-street, Russell-square. An improvement in rams for naval warfare.

Dated May 22, 1862.

1513. G. Crawford, Beaumont-street, Portland-place, pianoforte manufacturer. Improvements in musical instruments.

1545. S. and F. Turnbull, Holywell-mount, Shoreditch, card makers. Improvements in the manufacture of floor-cloths and like coverings.

1549. G. Barlow, Birmingham, manager. A new or improved method of laying submarine telegraphic cables. (A communication.)

1551. W. Roberts and T. Greenacre, Millwall. Improvements in cocks or valves for steam or other fluids.

Dated May 23, 1862.

1554. P. McGregor, Manchester, machine maker. Certain improvements in machinery for spinning and doubling cotton and other fibrous substances.

1555. R. Blacklidge, Accrington. Improvements in the preparation of materials for sizing, dressing, or finishing warps, yarns, textile fabrics, or paper, and also for thickening colours.

1557. W. E. Wiley, Graham-street, Birmingham, gold pen and pencil case manufacturer. Improvements in the manufacture of certain kinds of penholders; which improvements may also be applied to pencil cases and holders for crayons and other solid writing or marking materials.

1561. E. Maw, Leamington, engineer. Improvements in constructing ships, vessels, forts, and batteries.

1563. W. Clark, 53 Chancery-lane, engineer. A new manufacture of socks and stockings. (A communication.)

Dated May 26, 1862.

1565. J. Harrison, Blackburn, machine maker, and R. Parkinson, Blackburn, tin-plate worker. Improvements in the manufacture of rollers for preparing, spinning, doubling, sizing, winding, warping, and weaving.

1567. C. De Bergue, Strangeway's Works, Manchester. Improvements in iron framing, applicable to supporting coverings or surfaces intended to resist blows or pressure.

1568. C. Brakell, W. Hoehl, and W. Gunther, engineers, the North Moor Foundry Company, Oldham. Improvements in steam and other motive engines.

1569. M. Walls and J. Crompton, Bolton, engine drivers. Improvements in railway signals.

1571. W. Brierley, Halifax, and G. F. Smeeton, ironmonger. Improvements in apparatus connected with targets.

1573. W. Worby, Ipswich, engineer. Improvements in reaping machines.

1574. J. A. C. N. Delpech, Castres, France, manufacturer of engines and machinery. Improvements in pumps.

1575. R. M. Letchford, Three Colts-lane, Bethnal-green, match manufacturer. An improvement in the manufacture of matches.

1577. J. E. Holmes, New York, civil and mechanical engineer. Improvements in machinery for digging or cultivating land.

1579. J. E. Holmes, New York, civil and mechanical engineer. Improvements in printing machinery. (A communication.)

Dated May 27, 1862.

1581. E. Tuck, electro silver plater, 70A Leadenhall-street, City. Certain improvements in electrical manipulation, applicable to submarine telegraphs.

1583. W. E. Gedge, 11 Wellington-street, Strand. Improvements in the manufacture of wire rope or cables. (A communication.)

1585. J. Ireland, Manchester, foundry engineer. Improvements in forming moulds for card cylinders.

1587. W. Clark, 53 Chancery-lane, engineer. Improvements in brakes for railroad carriages. (A communication.)

1588. F. Tolhausen, C.E., 17 Faubourg Montmartre, Paris. A new or improved method of applying various mineral and organic substances to wire gauze, metallic and asbestos tissues, for rendering said tissues available for ornamental and useful purposes. (A communication.)

1589. G. H. Sanborn, Boston, U.S., gentleman. Improvements in revolving breech-loading fire-arms. (A communication.)

1590. J. Hay, Troon, N.B., Shipbuilder. Improvements in war ships, also applicable in part to floating and land batteries or forts, and in part to mercantile and other vessels.

1591. J. Duffus, Cullen, N.B., cabinet maker. Improved apparatus for measuring piece goods or webs.

1593. D. T. Moss, 16 Camden-terrace, Leeds. Improvements in fastening horse shoes.

Dated May 28, 1862.

1597. J. H. Kidd, Manchester, engineer. An improved manufacture of compositions applicable for waterproofing fabrics, for coating and protecting various articles, and for various other purposes.

1599. J. Rogerson, Newcastle-upon-Tyne. An iron floating dock to be used for the purpose of building and repairing ships, steamers, barges, and floating vessels of all descriptions.

1601. J. F. Harrison, Cambridge-square, Hyde-park, esquire. Improvements in preserving the bottoms of ships from the attacks of barnacles and other incrustations.

1603. T. Turner, Redditch, needle manufacturer. Improvements in machinery for scouring and polishing knitting and other pins and needles.

1605. J. Hirst, Jun., Dobcross, Saddleworth, and E. O. Taylor, Marsden, near Huddersfield. Improvements in means or apparatus for evaporating water and other fluids, and in economizing the use of steam.

1607. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in the manufacture of tinned lead pipes, and in the apparatus employed therein. (A communication.)

1608. W. Blackmore, Foynes, and H. Lamb, Ennis. Improvements in burning limestone, and generating steam.

1609. J. A. Ransome, Ipswich. Improvements in the manufacture of, and in fastening railway chairs with wood treenails.

Dated May 30, 1862.

1628. I. Leon, 2 Rue Ste. Appoline, Paris, France, horse-breaker. An improved curb or rein for enabling riders or drivers to stop restive or runaway horses.

Dated May 31, 1862.

1640. W. T. Smallwood, Narrow-street, Limehouse, and W. Wright, Dean's-buildings, West India-dock-road. Improvements in waterclosets.

1642. T. V. de Veye, 15 Passage des Petites Ecuries, Paris. A coating intended to protect iron from rust, and to preserve wood, cloth, paper, and pasteboard used for packing or roofing.

1650. L. Chaubart, Moissac, France, gentleman. An improved mode of, and apparatus for, raising the level of water in rivers, canals, and other watercourses.

Dated June 2, 1862.

1660. J. Baker, Coatbridge, Lanark, tube manufacturer. Improvements in pumps.

1662. C. E. Gray, 73 Great Suffolk-street, Southwark, tallow maker. Improvements in apparatus for extracting, rendering, receiving, purifying, cooling down, and delivering oleaginous and fatty matters or other material treated by steam pressure for extraction.

1664. W. E. Newton, 66 Chancery-lane, C.E. An improved mode of making the handles of shovels, spades, dung forks, and other analogous articles. (A communication.)

1666. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improved machinery for breaking and cleaning flax and other like fibre yielding plants. (A communication.)

1668. J. J. H. Gebhardt, Lawrence-lane, merchant. An improved fastening for bags, purses, and other similar articles. (A communication.)

Dated June 3, 1862.

1670. G. Gurney, Bude, Cornwall. Improvements in apparatus for production and application of artificial light.

1674. S. Weston, Tenterden. Improvements in trusses.

Dated June 4, 1862.

1678. G. Peel, Jun., Soho Foundry, Manchester, engineer, and Joseph Simpson, manager. Improvements in the construction, arrangement, and mode of working hydraulic presses, and in the arrangement of force pumps.

1680. W. James, Red-hill-house, Dudley, Worcester. Improvements in bolts, spikes, and nails, and in apparatus for their manufacture.

1682. R. Roe, Friargate, York, wholesale ironmonger. Improvements in planes for tongueing, working sash fillisters, or other similar purposes.

1684. G. B. Tosselli, 41 Threadneedle-street, architect. Improvements in apparatus for freezing and cooling liquids and mixing syrups.

1686. G. H. Sanborn, Boston, U.S. Improvements in refrigerators. (A communication.)

1688. E. Scheutz, Brompton, engineer. Improvements in rotatory engines.

1690. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in the construction of grain and grass harvesters. (A communication.)

Dated June 5, 1862.

1692. G. Rydill, 5 Wardrobe-place, architect. An improved hydraulic pump or engine for raising liquids and obtaining motive power, also applicable for the ventilation of mines and other useful purposes.

1694. J. Bell, Portobello, Midlothian, engineer. Improvements in fastenings for railway chairs.

1696. J. M. and J. Stanley, Ironfounders, Sheffield. Improvements in stoves or apparatus for diffusing heat.

1700. W. Rowe, East India-road, Poplar. An improved forge and bellows.

1702. G Hadfield, Bootle-village, near Liverpool, engineer. Improvements in the manufacture of casks or barrels, and in the machinery and apparatus to be used in the construction of the same.

Dated June 6, 1862.

1704. J. Verity, 1 Carlton-road, Kentish-town, house agent. An improved composition for coating and preserving walls or other exposed surfaces.

1706. G. Darlinson, Much Park-street, Coventry, ribbon manufacturer. Improvements in the manufacture of ribbons.

1708. A. V. Newton, 66 Chancery-lane, mechanical draughtsman. Improvements in knitting machinery. (A communication.)

Dated June 9, 1862.

1714. J. Lovegrove, Dalston-lane, Hackney, surveyor. Improvements in apparatus for inspecting small sewers and drains, and for facilitating the removal of obstructions therein.

1716. A. Ford, Priory, Battersea, Surrey, gentleman. An improved method of protecting beer and other fluids from the direct action of atmospheric air.

1718. J. Keeling, Reading. Improvements in apparatus for the manufacture of gas.

1720. C. W. Heckethorn, Saint Ann's-road, Brixton. Improved apparatus for obtaining and applying motive power.

Dated June 10, 1862.

1724. W. Smith, 19 Salisbury-street, Adelphi, C.E. Improvements in photography. (A communication.)

1726. J. Kinlock, Preston, manager, and T. Edmeston, machinist. Improvements in looms for weaving.

1730. H. C. Jennings, Great Tower-street. Improvements in the preparation of skins for driving bands, and harness traces.

Dated June 11, 1862.

1736. J. D. Wake, Cornhill, merchant. Improvements in the construction of ships and vessels.

1740. D. Crichton, machinist, W. Donbavand, scale, beam, and weighing machine manufacturer, and D. Crichton, engineer, Manchester. Improvements in looms for weaving.

1742. J. H. Johnson, 47 Lincoln's-inn-fields, gentleman. Improvements in cradles or swing cots. (A communication.)

1744. J. E. Holmes, South-parade, Trafalgar-square, Chelsea, mechanical and civil engineer. Improved machinery for cultivating or harrowing land. A communication.)

Dated June 12, 1862.

1746. J. Ingham, Valley Dye Works, Bradford, York, dyer and finisher, and W. P. Wood, analytical chemist. Improvements in preparing colouring matters for dyeing and printing.

1748. F. Tolhausen, C.E., 17 Rue du Faubourg Montmartre, Paris. A new or improved surgical injecting apparatus. (A communication.)

1750. H. S. Firman and W. J. Williams, 73 Great Suffolk-street, Southwark. Improvements in apparatus for cutting up and preparing as food or chaff for animals or for any other purpose straw, hay, corn-stalks, roots, and all other similar substances. (A communication.)

1752. A. Salviati, Venice, advocate. An improved mode of producing indestructible inscriptions and ornamental surfaces in gold and other precious metals. (A communication.)

1754. M. Jackson, Curtain-road, Shoreditch, dentist. An improved shield for the gums, to protect them from injury when cleaning the teeth.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1795. G. Haseltine, 100 Fleet-street, American barrister-at-law. Improvements in roofs for railroad cars and hurricane decks of vessels. (A communication.) Dated June 17, 1862.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

345. G. Smith. Shawls.

362. F. J. Bolton. Rifle and gun stoppers.

366. J. Robb. Apparatus for ventilation.

372. T. Spencer. Propellers.

373. A. Samuelson. Ships and vessels.

379. W. Williams. Pianofortes.

382. W. H. Brown. Yards, fore and aft booms and gaffs.

397. A. J. Dodson. Composition for coating, covering, or protecting ships' bottoms.

399. T. D. McFarlane. Sewing machines.

408. C. Turner and J. Shaw. Felted fabrics.

413. A. H. Harrison. Under garment.

417. J. Russell. Raising sunken, submerged, or stranded vessels.

423. E. T. Hughes. Apparatus for collecting the gases given off from furnaces. (A communication.)

434. W. Firth. Machinery for digging or turning up soil.

441. N. Symons. Steam engines.

457. C. Wood. Horse rakes.

464. E. S. Crease. Drilling, boring or excavating earthy substances.

467. W. McAdam and W. Chrystal. Sheaves or pulleys, journals, bushes, and other similar bearing or rubbing surfaces.

471. W. H. Ross. Manufacture of sugar. (A communication.)

479. D. B. White. Protecting liquids from the atmosphere.

495. L. Davis and F. M. Parkes. Manufacture of gas.

498. R. A. Brooman. Reaping and mowing machines. (A communication.)

499. J. Carnaby. Regulating the taps and valves of gas pipes.

505. W. Clark. Tobacco pipes. (A communication.)

506. T. Watson and R. Dracup. Preparing and combing wool.

512. C. Kingsford. Manufacture of bread.

527. W. Clark. Clasps. (A communication.)

531. J. Smith. Drying grain.

578. T. Tilliam. Purifying gas.

1045. F. Rigollot Manufacturing rivetting pegs.

1282. A. H. Fielden. Show jars, lamps, signals, and light-houses

1283. H. F. Broadwood. Pianofortes.

1591. J. Duffus. Measuring piece goods or webs.

1605. J. Hirst and E. O. Taylor. Evaporating.

1610. J. Critchley. Rib fastener.

1661. W. E. Newton. Making handles. (A communication.)

1666. A. V. Newton. Breaking and cleaning flax. (A communication.)

1690. A. V. Newton. Grain and grass harvesters. (A commuication.)

1692. G. Rydill. Ventilation.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Dated June 20, 1862.

3205. T. Morris, R. Weare, and E. H. C Monckton.

3215. L. R. Bodmer.

3216. C. Smith.

3217. J. Rosindell.

3218. C. Smith.

3229. J. Jones.

3230. T. Standing.

3231. J. Shepherd.

3239. T. Silver.

3241. P. A. Le Comte de Fontaine Moreau.

3251. M. Henry.

3204. J. Haslam.

3. J. H. Johnson.

39. A. V. Newton.

129. R. Romaine.

140. W. S. Mappin.

163. I. Martin.

183. J. Cornforth and B. Smith.

403. T. Renison.

755. J. A. Jaques, J. A. Fanshawe, and F. Jaques.

1763. G. Scoville.

Dated June 24, 1862.

3228. T. Simmons and T. Timmins.

3235. R. Needham.

3237. J. N. Palmer.

3240. W. Turner and J. W. Gibson.

3243. T. W. Atlee.

3246. R. A. Brooman.

3255. J. Gordon and B. Henderson.

3267. W. Spence.

3274. E. T. Hughes.

53. C. and T. Pilkington.

55. J. Stenhouse.

68. B. Thompson.

77. W. H. Preece.

118. J. A. Knight.

141. W. Boaler.

150. J. Stenhouse.

383. W. D. Allen.

719. J. Grant.

929. G. and J. Collier.

1010. J. T. Grice.

1301. A. V. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1494. L. D. Owen.

1492. J. Meikle.

1567. B. Standen.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1418. J. L. Jullion.

1431. W. Teall.

1412. F. W. Mowbray.

LIST OF SPECIFICATIONS PUBLISHED

During the week ending June 21, 1862.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2801	0 4	2812	0 3	2823	0 10	2834	0 3	2845	0 4	2856	0 1
2802	0 9	2813	0 10	2824	0 10	2835	0 6	2846	0 3	2857	0 6
2803	0 7	2814	0 6	2825	0 5	2836	0 10	2847	0 6	2858	[illegible]
2804	0 7	2815	0 3	2826	1 8	2837	0 7	2848	1 6	2859	[illegible]
2805	0 4	2816	1 7	2827	0 10	2838	0 3	2849	0 3	2860	0 9
2806	0 3	2817	0 7	2828	0 3	2839	0 3	2850	0 6	2861	[illegible]
2807	0 3	2818	0 3	2829	0 3	2840	0 6	2851	0 10	2862	0 3
2808	0 3	2819	0 3	2830	0 6	2841	0 7	2852	0 3	2863	[illegible]
2809	0 9	2820	0 3	2831	0 3	2842	0 6	2853	0 3	2864	[illegible]
2810	1 10	2821	0 6	2832	0 3	2843	0 7	2854	0 6	...	...
2811	0 10	2822	0 7	2833	2 1	2844	0 7	2855	0 3	...	...

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.		Nos. in Register.	Names and Addresses.	Subjects of Design.
May	8,	4477	J. Cocks, Cornhill	Waistcoat.
,,	,,	4478	J. Cocks, Cornhill	Coat pockets.
,,	10,	4479	J. Timmins & Co., Brearley-st., West, Birmingham	Oil can.
,,	13,	4480	T. Aldred, Oxford-st.	Lever check winch.
,,	17,	4481	J. Aston, School of Musketry, Hythe ...	Rotary jag.
,,	26,	4482	J. Hodgson, Newmarkt.	Plough.
,,	31,	4483	R. G. Coles, Fleetwood	Target.
June	3,	4484	Com. Hay and J. R. Stebbing, Southamptn.	Compound protractor.
,,	4,	4485	R. and E. Furness, 10 Trump-st., London	Collar and cravat
,,	5,	4486	R. Madeley, Birmnghm.	Flooring cramp.
,,	10,	4487	J. Ashburner, Lieut. ..	Target.
,,	14,	4488	Allen and Felton, Birmingham.	Calender.
,,	18,	4489	R. K. Day, Aldermanbury	Crinoline.
,,	20,	4490	Farrow and Jackson, Gt. Tower-street.	Bottle stopper.

PROVISIONAL REGISTRATIONS.

May	7,	1317	J. B. Donnell, Chapel-street, Park-walk ...	The desideratum.
,,	14,	1348	F. C. Coster, York-rd. Lambeth	Chimney cap.
,,	15,	1349	A. Tenniel, Wellington-rd. St. John's-wood	Cravat front.
,,	16,	1350	Dr. A. King, Old Steyne, Brighton ...	Box respirator.
,,	19,	1351	H. Heyer, Earl-street, Finsbury	Copying press.
,,	21,	1352	J. Newton, Eastbourne-terrace, Paddington	Stove.
,,	27,	1353	R. Rains, Crescent, Bridge-st., Blackfriars	Machine for freezing, &c.
,,	28,	1354	J. R. Lyeds, Rotherhithe Wall	Balancing needles.
June	3,	1355	T. K. Mace, Ball-street, Birmingham	Hat suspender.
,,	12,	1356	J. Crockford, Camden-town	Washing-tub.
,,	11,	1357	J. W. Wyatt and Co. Bunhill-row	Skirt.

PRICES CURRENT OF METALS.

London, June 26, 1862.

		£	s.	d		£	s.	d	
IRON:									
Rails in Wales and North of England	pr. ton	5	0	0	to	5	5	0	—
Welsh Bars, in Wales	,,	5	5	0	,,	5	7	6	—
Staf. Bars, at the Works ..	,,	7	0	0	,,	7	5	0	—
,, Hoops	,,	7	10	0	,,	8	0	0	—
,, Sheets, Singles	,,	9	0	0	,,	10	0	0	—
,, Nail Rods	,,	8	15	0	,,	9	10	0	—
,, Boiler Plates	,,	8	8	0	,,	9	12	6	—
Scotch Pig, M.-Nos. Warrants, at Glasgow	,,	2	10	8	,,	2	11	0	nett
Do. No. 1, Good Brands ..	,,	2	11	6	,,	2	15	0	—
Scotch Bars	,,	7	5	0	,,	7	15	0	—
Swedish Bars, in London ..	,,	10	10	0	,,	11	0	0	—
COPPER:									
Sheet and Sheathing	per lb.	0	0	11	,,	0	0	0	3
Tough Cake and Tile.......	pr. ton	95	0	0	,,	0	0	0	—
Best Selected	,,	101	0	0	,,	0	0	0	—
Australian	,,	99	0	0	,,	0	0	0	—
South American	,,	0	0	0	,,	0	0	0	—
Yellow Metal Sheathing ..	per lb.	0	0	8	,,	0	0	0	2½
STEEL.									
Swedish Keg................	pr. ton	15	0	0	,,	0	0	0	2½
,, Faggot	,,	16	0	0	,,	0	0	0	—
TIN:									
English, Block...............	p. cwt.	6	0	0	,,	0	0	0	2½
,, Bar..............	,,	6	1	0	,,	0	0	0	—
Foreign, Banca	,,	6	3	0	,,	0	0	0	nett
,, Straits	,,	5	17	0	,,	0	0	0	—
TINPLATES:									
Charcoal, I.C.	pr. box	1	7	0	,,	1	9	0	3
Coke, I.C..................	,,	1	1	6	,,	1	4	0	—
LEAD.									
Pig, English................	pr. ton	20	0	0	,,	21	0	0	2½
,, Spanish	,,	19	10	0	,,	19	15	0	—
Common Sheet	,,	21	0	0		0	0	0	—
Tea ,, (Wimshurst's Patent) A special disct...	,,	36	0	0	,,	0	0	0	—
SPELTER:									
On the spot	,,	17	10	0	,,	18	0	0	nett
For arrival	,,	17	10	0	,,	17	15	0	—
ZINC:									
English Sheet	,,	23	0	0	,,	0	0	0	1
QUICKSILVER.............	pr. btl.	7	0	0	,,	0	0	0	3

JAMES LAURIE, Metal Broker,

50 King William Street, E.C.

Digitized by Google

19

Digitized by Google

Digitized by Google

Digitized by Google

THE NEW YORK PUBLIC LIBRARY
REFERENCE DEPARTMENT

his book is under no circumstances to be
taken from the Building